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Research Article

Formulation and Evaluation of Herbal Dye Shampoo

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Abstract

Hair plays a vital role in framing the beauty and personality of an individual. Greying of hair is a natural process, that happens with everyone after a certain age due to various genetic and environmental factors. People use herbal formulations because of their better activity and lesser side effects with synthetic drugs. The present research emphasizes the formulation and evaluation of herbal hair dye shampoo formulation. The herbal hair dye shampoo is prepared by using various natural extracts for the dyeing effect and a shampoo base to promote hair washing. The prepared formulation contains Henna powder, Black catechu, Aloe vera gel, Tea powder, Coffee powder, Lemon juice, Guar gum, Clove buds, Rose oil, H_2O_2 liquid, Sodium Lauryl Sulphate, Reetha extract (foam), Shikakai extract and Distilled water. Various marketed hair cosmetics such as hair dyes and shampoos involve the use of hazardous chemicals that result in toxic effects on human skin and hair. Also, the preparations involve the use of processed products rather than natural substances. Hence, there is a need to prepare formulations containing crude drugs without processing with negligible concentrations of synthetic chemicals that are ready to use and have no side effects. The prepared herbal hair dye shampoo shows permanent dyeing and also acts as a good shampoo without causing any adverse reactions to your skin. It is consumer-friendly, effective, and stable.

Keywords: Greying of Hair; Henna; Black Catechu; Aloe Vera; Tea; Coffee; Lemon; Guar Gum; Clove; Rose Oil; H_2O_2; Sodium Lauryl Sulphate; Reetha; Shikakai; Cosmetics; Side Effects; Crude Drug

Introduction

Ayurveda includes utilizing many herbs and floras to manufacture cosmetics for beautification and protection from external effects. The natural content of herbs enriches the body with nutrients and other useful minerals and does not cause any side effects [1]. Shampoo is a preparation that includes surfactant in a suitable form-liquid, solid, or powder which can remove surface grease, dirt, and skin debris from the hair, shaft, and scalp when used under the specified conditions without harming the health of the consumer [2]. Shampoos are composed of various ingredients such as cleansing agents, additives that provide stability and comfort to the product, conditioning agents that impart softness and gloss, and special care ingredients that treat hair problems [3].

In ancient Greece, a potassium solution was used to bleach hair and then rubbed with a type of ointment made of yellow flower petals and pollen. Rameses II reinforced red hair colour using henna. People have been using hair dyes since ancient Egyptian times. The hair shaft consists of four main parts which include structures such as the cuticle, cortex, cell membrane complex (CMC), and the medulla. The cortex forms a matrix and exhibits certain structures such as keratin macro fibrils aligned in the direction of the hair strand and melanin granules which are responsible for the hair colour and its photoprotection [4].

In Ayurved 'keshya karma' is useful for hair and it includes 'vardhanam' which is used for the promotion of hair growth and 'ranja-

nam' which is used for dyeing hair. Kesaranjan acts by maintaining the actual beauty of hair in keshavikar 'palitya' means premature greying which is common nowadays. Some plants are used in cosmetics for their hair colouring, growth-promoting, and anti-aging properties. Nowadays many of us are suffering from hair disorders that cause sudden loss of hair and lead to baldness and sometimes loss of hair colour and is mainly due to chemical agents, toxins, and microbes present in the atmosphere and also due to physical factors, malnutrition and environmental factors [5]. Natural dyes are obtained from plant, animal, or insect matter without any chemical processing. In ancient times natural organic matter was made by mixing two or more metals in it to make long-lasting and richer shades of dyes. Natural dyes are used as mordants which contain the main phytoconstituent as tannins. And tannins have a great ability to colour and increase the timing of dye between dyes and hair [6]. Many mordants are also used in formulating dyes. The principle behind this is that the mordant joins with the fiber and the dye to set the colour permanently. Mordant enters deeply into the hair fiber and after the addition of dye, they combine to form a colour [7].

Aim

To formulate and evaluate herbal dye shampoo by using herbal extracts and shampoo base.

Objectives

- To formulate an herbal hair dye shampoo for dyeing hair with promotion of hair growth and prevention of hair damage.
- To prepare an effective herbal hair dye shampoo with negligible concentration of synthetic chemicals.
- To formulate a combination of a dye and a shampoo with better activity, no side effects, and lesser harm to human skin and hair.
- To evaluate various parameters like organoleptic, physiochemical, phytoconstituents, rheological aspects, patch test and stability testing, etc.

Methods and Evaluation of Shampoo

Materials

Henna leaves were collected from the campus garden, dried in a tray dryer, and then ground into powder in a mixer. Black Catechu purchased from a shop vendor, Aloe Vera gel, lemon juice, tea powder, guar gum, coffee powder, clove buds, and rose oil, H_2O_2 liquid.

Shampoo Base ingredients: Sodium Lauryl Sulphate, Reetha extract (foam), Shikakai extract, distilled water.

Method of Extraction by using Soxhlet extractor

- **Black catechu extraction:** The Soxhlet extractor was used for the extraction procedure. Alcohol was utilized as the solvent. A Soxhlet extractor with ethanol was filled with black catechu powder. The extract was then collected in the flask after the extraction process had been running for around 6 hours. The extract was then boiled to remove the remaining solvent.
- **Aloe vera gel extraction:** The gel was taken from the aloe vera plant and blended into a smooth liquid using a mixer. And the clear Aloe Vera gel was collected.
- **Extraction of Shikakai:** A beaker containing the Shikakai powder and distilled water was put on the heating mantle. After boiling, it was cooled. The formed liquid was then filtered, and centrifuged for 20 minutes in a centrifuge machine, and the liquid's supernatant was used to prepare the formulation.
- **Extraction of Reetha:** Reetha powder was weighed and dissolved in distilled water in a beaker and placed on a heating mantle. Then it was boiled and cooled. Then the formed liquid was filtered and centrifuged in a centrifuge machine and a supernatant layer of liquid after centrifugation was taken. The supernatant layer was subjected to an aerated floating process with the help of an aerator to produce bubbles. The bubbles were collected and allowed to settle to form saponin extract. This extract was used for preparing the formulation.
- **Decoction of tea powder, coffee powder, and clove buds by using a heating mantle:** Clove buds, tea, and coffee powders have been precisely measured and combined with distilled water in a beaker to boil until a concentrated extract is obtained. The formulation is then made using this extract.

Formulation

Shampoo base preparation

In a beaker, distilled water was used to dissolve accurately weighed SLS powder. Extracts of Reetha and Shikakai were added. To make up the volume, distilled water was also added.

Dye preparation

Catechu extract along with tea powder, coffee powder and clove bud decoction extract, aloe vera gel, lemon juice, H_2O_2, guar gum, fine henna powder were combined and lastly few drops of rose oil were added and dye was formulated a by mixing all these ingredients.

Serial no.	Ingredient used	Percentage	Category
1.	Henna	10	Used to dye skin, hair, and fingernails, as well as fabrics including silk, wool, and leather [8].
2.	Black catechu	10	Used as a colouring and dyeing agent [9].
3.	Aloe Vera	10	Natural mordant, used in abrasion and skin irritation, Anti-inflammatory [10,11].
4.	Lemon juice	4	Preservative.
5.	Tea powder	3.5	Increase the colour. Intensity of hair [4].
6.	Coffee powder	3.5	Natural dyeing agent [12].
7.	Clove buds	3	Clove contains tannins a natural hair colouring agent that helps in the production of the colour that is a brownish-yellow colour [13].
8.	Guar gum	2	Thickening agent, Stabilizing agent [11].
9.	H_2O_2	4	Oxidising agent.
10.	Rose oil	0.1	Fragrance.
11.	SLS	5	Fat Emulsifier, Wetting agent, Detergent in Cosmetics [11].
12.	Reetha	7.5	Detergent and antidandruff agent [14].
13.	Shikakai	7.5	Antifungal, Nourish, Follicles, cure dandruff [11].
14.	Distilled water	30	To make up the volume.

Table 1: Ingredients.

Evaluation parameters

- **Physical appearance/visual inspection:** The resulting formulation's clarity, colour, and odour, as well as its capacity to produce foam and fluidity, were assessed [15].
- **Determination of pH**: 10% dye shampoo was taken in 100 ml distilled water and its pH was determined using pH meter and Litmus paper [15].
- **Determination of percent of solid contents**: First, a clean dry evaporating dish was weighed accurately. Then the same was weighed by adding 10 gm. of dye shampoo in it. The correct weight of shampoo was determined and the evaporating dish with shampoo was placed on a hot plate till the liquid portion was gaseous. After drying, the weight of the dye shampoo only (solid contents) was calculated accurately [15].
- **Rheological evaluation**: The viscosity of the dye shampoo was determined by using a Brookfield viscometer set at 0.6 rpm speed. The viscosity of dye shampoo was measured by using spindle 62. The temperature and sample container size were kept constant during the study [11].
- **Dirt dispersion**: A large test tube containing 10 ml of distilled water was taken. 2 drops of dye shampoo were added to it followed by the addition of 1 drop of Indian ink. The test tube was stopped and shaken 10 times. The amount of ink in the foam was recorded as None, Light, Moderate, and Heavy [11].
- **Cleaning action**: In a beaker containing 200 ml of distilled water, 1 gram of shampoo was added. 5 grams of wool yarn were placed in grease and added to the mixture of shampoo and water, maintaining the temperature of water at 35^0C. For 4 minutes, the flask was shaken 50 times each minute. The solution of water and dye shampoo was removed. The sample of wool yarn was taken out, dried, and weighed. The amount of grease removed was determined 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 [11].

- **Foam ability and foam stability**: The foaming ability of dye shampoo was determined using the cylinder shake method. 50 ml of 1% dye shampoo solution was taken into a 250 ml graduated cylinder. The cylinder was shaken 10 times, and covered with a hand. The volumes of foam were recorded after every 1-minute shaking. The foam volume was calculated only. The volumes of foam immediately after shaking were recorded at 1-minute intervals and this was done for 4 minutes [11].
- **Patch Test:** This test involves dabbing a small amount of the aqueous solution of dye shampoo behind the ear or on the inner elbow in an area of 1 sq. cm and leaving it to dry. Signs of irritation, swelling, and redness were observed for regular intervals up to 24 hours [16].
- **Ash value**: 5 ml of dye shampoo weighed in a crucible was placed in a muffle furnace at 600ºC to determine ash value.
- **Stability studies**: The thermal stability of formulations was studied by placing them in glass vials by storing them under the following conditions of temperature as 3-5ºC, 25ºC RH=60%, 45 ºC RH= 75% and were later analysed after 3 months [15].
- **Dyeing effect**: The formulation was applied for 15 minutes and washed followed by observing the hair colour. The same bundle of hair was then subjected to washing after 15 days and hair colour was observed.

Results and Discussion

Physical appearance/visual inspection

Results for physical appearance are tabulated in the table as follows.

Sr. No.	Parameter	Observation
1	Colour	Brownish (coffee)
2	Odour	Characteristic
3	Foam	Good
4	Fluidity	Good
5	Homogeneity	No particulate matter present
6	Clarity	Clear

Table 2: Physical Appearance.

Determination of pH

The pH of the formulated dye shampoo was found to be 5.85, which is near to the pH of the skin by pH meter determined at room temperature 25°C. pH of the skin ranges from 4.8 to 6.0 which is slightly acidic and the pH of the dye shampoo falls under this range. pH of the shampoo plays an important role in improving and enhancing the qualities of hair, minimizing irritation to the eyes, and stabilizing the ecological balance of the scalp. Mild acidity prevents swelling and promotes tightening of the scales [15].

Determination of percent of solid contents

It is said that if the shampoo has too many solids it will be hard to work into the hair or too hard to wash out [15]. Lower solid content makes the shampoo watery and clear of hair quickly and if it is between 20 to 30% then the test will be passed [17]. The solid contents in formulated dye shampoo are found to be 21.43%.

Rheological evaluation

The viscosity of the formulation was determined by using a Brookfield viscometer. The spindle was used at a speed of 0.6 rpm. The dye shampoo had a creamy texture.

Dirt dispersion

Spindle number	Dial reading	Factor	Viscosity Centipoise (Cp)
62	2	1000	2000

Table 3: Rheological evaluation.

Poor-quality shampoos are those that cause ink to concentrate in water. The ink should stay in the water. The dirt will redeposit on the hair and it will be difficult to rinse away. As a result, the prepared formulation is satisfactory as there is no dirt present in the foam. The amount of ink in the foam is recorded as "Light" [11].

Cleaning action

The cleaning action of formulated dye shampoo was calculated by applying grease on wool yarn. The percentage of detergency of formulated dye shampoo is found to be 24.84% [15].

Foam ability and foam stability

The results of foam ability and foam stability of formulated dye shampoo are tabulated below.

Time in minutes	Foam volume
0	72ml
4	71ml
8	71ml
12	71ml
16	71ml

Table 4: Foam Stability.

Patch test

The results of the patch test are tabulated below.

Ash value

The ash value of formulated dye shampoo was found to be 15%.

Sr. No.	Parameter	Result
1	Irritation	Negative
2	Swelling	Negative
3	Redness	Negative

Table 5: Patch Test.

Stability studies

Accelerated stability and acceptability of formulation with its organoleptic properties like odour and colour during the storage period of 3 months show that the prepared formulation is chemically and physically stable.

Dyeing effect

After application of formulated herbal dye shampoo for 15 minutes and immediate washing.

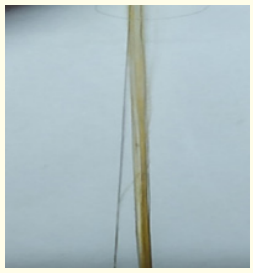

Figure 1

After washing the same hair for 15 days.

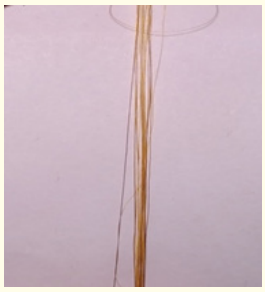

Figure 2

Conclusion

The prepared herbal hair dye shampoo is found to be a good dyeing formulation as well as a shampoo. It is found that it colours white hair to brown. The formulated dye is found to be permanent and shows good colouring activity than marketed formulations. This formulation is free from hazardous chemicals, and skin irritants, nontoxic, and does not develop any kind of side effect. The developed formulation shows more beneficial properties like promotion of hair growth and prevention of greying of hair, being safe and eco-friendly.

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