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Research Article

PREPARATION AND EVALUATION OF SHAMPOO POWDER CONTAINING HERBAL INGREDIENTS

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ABSTRACT

Objective: The aim was to formulate an herbal shampoo powder containing natural ingredients with an emphasis on safety and efficacy, which will avoid the risk posed by chemical ingredients. It clears sebum, dirt, dandruff, promotes hair growth, strengthens, and darkens the hair. Moreover, it also acts as a conditioning agent and performs all these actions without affecting or damaging hair. The herbs amla, bhringaraj, hibiscus, shikakai, and ginger have been selected to formulate the herbal shampoo powder on the basis of the traditional system and scientific justification with modern uses.

Methods: Herbal shampoo powders were accurately weighed, passed through sieve no.100, prepared by mixing in their ascending order of quantities with continuous trituration, stored in air tight containers and used for further studies. All the five formulations (F1-F5) were subjected to organoleptic studies, general powder charecterstics, physicochemical evaluation, ash and alcohol soluble extractives, moisture content determination, pH determination, cleaning action, foaming capacities, dirt dispersion, wetting time and studies on nature of hair after wash.

Results: All the five formulations (F1-F5) offered a suitable practical approach and achieved a better usage. General powder characteristics showed results in specified limits. Physicochemical evaluations, pH determination, ability to remove grease, foaming capacity, dirt dispersion, wetting time and nature of hair after wash were found to yield satisfactory results for F2 formulation.

Conclusion: The present work confirmed the successful preparation of herbal shampoo powders by mixing method without using other excipients in different concentrations. Among all the five formulations (F1-F5) F2 yielded satisfactory results.

Keywords: Herbal shampoo powder, Organoleptic properties, Formulation and evaluation methods.

INTRODUCTION

Hair is one of the external barometers of internal body conditions. It is an important part of human body. Various synthetic compounds, chemicals, dyes and their derivatives have been proved to cause harmful effects. Nowadays, people are having an awareness of their effects on hairs skin and eyes. Due to these reasons the community is getting attracted towards herbal products due to their inexpensive nature and negligible side-effects [1]. Herbal cosmetics are denoted as products formulated using various permissible cosmetic ingredients to form the base in which one (or) more herbal ingredients are used to provide accurate cosmetic benefits [2]. Nowadays, the usefulness of herbs in the cosmeceutical production has been extensively increased and there is a great demand for the herbal cosmetics. Shampoos are of various types, such as powder shampoo, clear liquid shampoo, lotion shampoo, solid gel shampoo, medicated shampoo, liquid herbal shampoo, and herbal shampoo powder, etc. As far as the herbal shampoos are concerned in stability criteria, depending upon the nature of the ingredients, they may be simple (or) plain shampoo, antiseptic (or) antidandruff shampoo and nutritional shampoo containing vitamin, amino acids, proteins hydrolysate [3]. The selection of active ingredients for hair care powders is based on the ability of the ingredient to prevent skin damage as well as to improve the quality of skin by cleansing, nourishing and protecting the skin. In this study, formulation and evaluation of herbal shampoo powders are reported.

The objective of the present research work is to develop an herbal shampoo powder which clears sebum, dirt, dandruff, promotes hair growth, strengthens, and darkens hair. Moreover, it also acts as a conditioning agent. This herbal shampoo powder performs all these actions without affecting or damaging hair.

METHODS

Collection of materials

Different parts of plant were selected to study hair care property. The plants are amla fruit (*Emblica officinalis*), hibiscus leaves (*Hibiscus rosea*), shikakai fruit (*Accacia concina*), ginger root (*Zingiber officinalis*) and bhringaraja leaves (*Eclipta alba*). All the required powders of amla fruit, hibiscus leaves, shikakai fruit, ginger root and bhringaraja leaves were collected from the local herbal drug store market. The raw materials collected were given with their biological source and uses respectively in Table 1.

Method of preparation of herbal shampoo powder

These powders were accurately weighed, passed through sieve No. 100 and then mixed in their ascending order of quantities with continuous

Table 1: The herbs used in the preparation of herbal shampoo powder

S.No	Constituents	Biological source	Use
1	Amla fruit	Dried ripe fruits of *E. officinalis*	Hair darkening Hair growth promoter
2	Hibiscus leaves	Dried leaves of *H. rosea*	Hair conditioner Hair growth promoter
3	Shikakai fruit	Dried pods of *A. concinna*	Foaming agent Anti-dandruff agent
4	Ginger root	Dried rhizomes of *Z. officinalis*	Anti-dandruff agent
5	Bhringaraja leaves	Dried leaves of *E. alba*	Hair darkening Hair growth promoter

E. officinalis: Emblica officinalis, H. rosea: Hibiscus rosea, A. concinna: Acacia concinna, Z. officinalis: Zingiber officinalis, E. alba: Eclipta alba

trituration and stored in airtight containers until it was used for further studies [4]. Five batches of the herbal shampoo powder formulations (F1-F5) were prepared, labeled and stored in a well closed container and used for further studies. The preparation formula are given in Table 2.

Evaluation of herbal shampoo powder

Organoleptic studies

Organoleptic evaluation studies were performed by taking the samples randomly for the parameters like color, odor, taste and texture [5,6].

General powder characteristics

General powder characteristics included particle size, angle of repose, bulk density and tapped density, which in turn affects external properties like flow property, etc. hence they are evaluated [7-9].

Particle size

The particle size of herbal shampoo powder was determined by using microscopic method. Place the stage micrometer on the stage of the microscope and initially focus on lower power by positioning the object to the centre of the object. Focus the object, measure the size of each particle in terms of eyepiece division. Select two points one on left side other on right side. Calculation can be done by using calibration factor:

$$\text{Calibration factor} = \frac{\text{Number of stage divisions}}{\text{Number of eye piece divisions}} \times 10$$

Angle of repose

A glass funnel was held in place with a clamp on ring support over a glass plate. The glass plate was placed on a micro lab jack. Approximately, 10 g of the powder was transferred into the funnel keeping the orifice of funnel blocked by the thumb. As the thumb was removed, the lab jack was adjusted so as to lower the plate and maintain about 2 cm gap between the bottom of the funnel stem and the top of the powder pile. When the powder was emptied from the funnel, the angle of the heap to the horizontal plane was measured with a protractor. The height and radius were measured using a ruler. The angle of repose was thus estimated by the following formula. It is expressed in g/cm^3.

$$\Theta = \tan^{-1}(h/r)$$

Where,

h=Height of the pile formed.

r=The radius of the base of pile.

Bulk density

The bulk density of a powder is the ratio of the mass of an untapped powder sample and its volume, including the contribution of the inter particulate void volume. Hence, the bulk density depends on both the density of powder particles and the spatial arrangement of particles in the powdered. The bulk density is expressed in g/cm^3. A volume of 100 ml graduated cylinder was taken and required amount of herbal shampoo powders (F1-F5) was added to the graduated cylinder. This was transferred to bulk density apparatus and bulk density was calculated. It is an important property for packaging and uniformity in the bulk of the product.

Bulk density=Mass of powder/Bulk volume of the powder

Table 2: The formulations of herbal shampoo powder

S.No	Constituents	F1	F2	F3	F4	F5
1	Amla	20	23	28	32	30
2	Hibiscus	09	07	08	06	05
3	Shikakai	08	10	06	07	12
4	Ginger	06	04	05	06	04
5	Bhringaraja	12	20	25	19	27

Tapped density

Required amount of herbal shampoo powders (F1-F5) was taken and placed in 100 ml graduated cylinder and tapped for 2 minutes until little change in volume was observed. It is expressed in g/cm^3. The tapped density is calculated by using the following formula:

Tapped density=Mass of the powder/tapped volume of the powder

Physicochemical evaluation

Extractive values [10]

Determination of alcohol soluble extractive

4 g each of the dried herbal shampoo powder was weighed and macerated with 100 ml of 90% alcohol in a 250 ml conical flask for 24 hrs, shaking frequently for every 6 hrs and allowed to stand for 18 hrs. Filter into a 50 ml cylinder. When sufficient filtrate has collected; transfer 25 ml of the filtrate to a weighed, thin porcelain dish, as used for the ash values determinations. Evaporate to dryness on the water bath and complete the drying in an oven at 105°C for 6 hrs. Cool in a dessicator for 30 minutes and weigh immediately. Calculate the percentage w/w of extractive with reference to air-dried shampoo powders (F1-F5).

Alcohol 90% soluble extractive value of the sample=80 × %

Determination of water soluble extractive

4 g each of the dried herbal shampoo powder was weighed and macerated with 100 ml of chloroform in a 250 ml conical flask for 24 hrs shaking frequently during 6 hrs of shaking and allowed to stand for 18 hrs. Filter into a 50 ml cylinder. When sufficient filtrate has collected; transfer 25 ml of the filtrate to a weighed, thin porcelain dish, as used for the ash values determinations. Evaporate to dryness on the water bath and complete the drying in an oven at 105°C for 6 hrs. Cool in a dessicator for 30 minutes and weigh immediately. Calculate the percentage w/w of extractive with reference to air-dried shampoo powders (F1-F5):

Water-soluble extractive value of the sample=80 × %

Ash value

This value is used to determine quality and purity of herbal shampoo powder and to establish the identity of it.

Determination of total ash

A flat, thin, porcelain dish or a tarred silica crucible was weighed and ignited. About 2 g of herbal shampoo powder formulation (F1-F5) were weighed and taken into a dish. Support the dish on a pipe-clay triangle placed on a ring of retort stand. Heat the dish about 7 cm above the flame, with the help of a burner, using a flame of about 2 cm high, heat till vapors almost cease to be evolved, then lower the dish and heat more strongly until all the carbon is burnt off. Cool in a dessicator. Weigh the ash and calculate the percentage of total ash with reference to the air dried shampoo powders.

Total ash value of the sample=100(z-x)/y%

Determination of acid insoluble ash

After determining total ash value using 25 ml of dilute hydrochloric acid, wash the ash from the dish used for total ash into a 100 ml beaker. Place mere gauze over a Bunsen burner and boil for 5 minutes. Filter through an ash less filter paper; wash the residue twice with hot water. Ignite a crucible in the flame, cool and weigh. Put the filter paper and residue together into crucible, heat gently until vapors cease to be evolved and then more strongly until all carbon has been removed. Cool using a dessiccator. Weigh the residue and calculate acid-insoluble ash with reference to the air-dried herbal shampoo powders (F1-F5).

Acid-insoluble ash value of the sample=100 × a/y%

Moisture content determination

10 g of herbal shampoo powder formulations (F1-F5) was placed in a tarred evaporating dish and kept in hot air oven for 105°C. The weight loss was observed at an interval of 15 minutes until constant weight was obtained.

pH

A pH meter is an electronic device used for measuring the pH of a liquid. A typical pH meter consists of a special measuring probe connected to an electronic meter that measures and displays the pH reading [11].

1 g each of herbal shampoo powder formulations (F1-F5) was taken and dissolved in 10 ml of water. Their pH was checked with the help of pH meter.

Cleaning action

5 g of wool yarn/cotton ball was taken and placed in grease; the same was then placed in a 200 ml of water containing 1 g of each herbal shampoo powder formulations (F1-F5) in a flask and was shaken for 4 minutes. The solution was removed and sample was taken out, dried and weighed. The amount of grease removed was calculated using the formula [12]:

$$DP=100\ (1-T/C)$$

Foaming capacity

2 g of each herbal shampoo powder formulations (F1-F5) were taken in a 250 ml graduated cylinder, 50 ml of water was added and shaken for 5-10 times. The foaming capacities of all the five formulations (F1-F5) after 1 minute shaking and % foaming capacities of all the five formulations (F1-F5) for a time period of 60 minutes were performed [13].

Table 3: The evaluation parameters of organoleptic studies

Evaluation parameters	F1	F2	F3	F4	F5
Organoleptic studies					
Color	Brownish	Brownish	Brownish	Brownish	Brownish
Odor	Slight	Slight	Slight	Slight	Slight
Texture	Fine	Smooth	Smooth	Fine	Fine

Dirt dispersion

Two drops of each 1% herbal shampoo powder formulations (F1-F5) were added in a large test tube containing 10 ml of distilled water. A drop of Indian ink was added; the test tubes were stoppered and shaken. The amount of ink in the foam was estimated as none, moderate, or heavy [14].

Wetting time

A canvas was taken and cut into 1 inch diameter discs. The discs were floated on the surface of each formulations (F1-F5) of 1% herbal shampoo powder solution and time was noted. The time required for the disc to begin to sink was measured accurately and noted as wetting time [15].

Nature of hair after wash

Nature of hair after wash was done by applying a small quantity of herbal shampoo powder formulations (F1-F5) on hair and then washed [16].

RESULTS

Organoleptic evaluation

The result of visual inspection for all the herbal shampoo powders were observed and evaluated for color, odor, taste and in terms of their appearance, flow property and texture. They are somewhat shows distinct change in color. The results were reported in Table 3.

General powder characteristics

The particle size, angle of repose, bulk density and tapped density results were determined. All the herbal shampoo powder shows the result in the specific limits for the respective evaluation parameters. The results were reported in Table 4.

Physicochemical evaluations

Extractive values

Alcohol soluble extractive values for F1, F2, F3, F4 and F5 formulations were 15.94% w/w, 17.4% w/w, 16.86 w/w, 16.88% w/w and 17.14% w/w respectively. Water soluble extractive value for F1, F2, F3, and F4 and F5 formulations were 12.25% w/w, 12.98% w/w, 13.25% w/w, 12.58% w/w and 12.33% w/w respectively. These values were reported in Table 5.

Ash value determination

Total ash value for F1, F2, F3, F4 and F5 formulations were 4.25% w/w, 4.15% w/w, 4.3% w/w, 4.62% w/w and 4.57% w/w respectively. Acid insoluble ash value for F1, F2, F3, F4 and F5 formulations were

Table 4: The general powder characteristics

Evaluation parameters	F1	F2	F3	F4	F5
General powder characteristics					
Particle size	20-25 µm	20-25 µm	20-25 µm	20-25 µm	20-25 µm
Angle of repose	21°	22°	24°	23°	22°
Bulk density	0.31 g/cm^3	0.27 g/cm^3	0.29 g/cm^3	0.32 g/cm^3	0.33 g/cm^3
Tapped density	0.35 g/cm^3	0.34 g/cm^3	0.33 g/cm^3	0.36 g/cm^3	0.37 g/cm^3

Table 5: The physicochemical evaluation studies

Evaluation parameters	F1	F2	F3	F4	F5
Physicochemical evaluation					
Extractive values					
Alcohol soluble	15.94% w/w	17.4% w/w	16.86% w/w	16.88% w/w	17.14% w/w
Water soluble	12.25% w/w	12.98% w/w	13.25% w/w	12.58% w/w	12.33% w/w
Ash value					
Total ash	4.25% w/w	4.15% w/w	4.3% w/w	4.62% w/w	4.57% w/w
Acid insoluble ash	1.25% w/w	1.37% w/w	1.32% w/w	1.12% w/w	1.07% w/w
Moisture content	3.09% w/w	3.62% w/w	3.19% w/w	3.30% w/w	3.41% w/w
pH	5.7	5.85	5.6	5.9	6.0

1.25% w/w, 1.37% w/w, 1.32% w/w, 1.12% w/w and 1.07% w/w respectively. These values were reported in Table 5.

Moisture content

Moisture determined for F1, F2, F3, F4 and F5 formulations were 3.09%, 3.62%, 3.19%, 3.30% and 3.41% respectively as reported in Table 5.

Determination of pH

All the five formulations (F1-F5) of herbal shampoo powders were acid balanced and were ranged 5.6-6.0. F2 formulation showed slightly acidic pH which may not cause damage to hairs. The results were reported in Table 5.

Cleaning action

As cleaning is the primary action of a shampoo powder, cleaning action was tested on wool yarn in grease. As seen from the results there is a significant difference in the amount of grease removed by all the five batches of formulated herbal shampoo powders. The cleaning action of F1, F2, F3, F4 and F5 formulations were observed as 29.5%, 33.2%, 31.3%, 28.6% and 30.4% respectively. F2 formulation portrayed good ability in the removal of grease compared to the other four formulations. These were reported in Table 6.

Foaming capacity

All the five formulations of herbal shampoo powders have comparable foaming characteristics in distilled water. The total foam volume of herbal shampoo powders after 1 minute shaking ranged from mild to good was recorded. The average percentage foaming capacities for F1, F2, F3, F4 and F5 formulations for a time period of 60 minutes were observed as 151.8%, 218.6%, 148.3%, 214.15% and 150.17% respectively and were reported in Tables 7 and 8.

Dirt dispersion

Shampoo powders that cause the ink to concentrate in the foam are considered as poor quality, the dirt should stay in water. Dirt that stays in the foam will be difficult to rinse away and will be redeposited on the hair. The amount of ink in the foam of F1, F2, F3, F4 and F5 formulations of herbal shampoo powders were evaluated and were ranged from moderate to light respectively. F2 and F3 formulations showed less dirt dispersion compared with others and the results were reported in Table 9.

Table 6: The cleaning evaluation parameters

Evaluation parameter	F1	F2	F3	F4	F5
Cleaning action	29.5%	33.2%	31.3%	28.6%	30.4%

Table 7: The foaming capacities of all the five formulations

Evaluation parameter	F1	F2	F3	F4	F5
Foaming capacity	Mild foam	Good foam	Good foam	Good foam	Good foam

Wetting time

Wetting time of a substance is a function of its concentration. The wetting time of the F1, F2, F3, F4 and F5 formulations were observed as 3 minutes 10 seconds, 2 minutes 30 seconds, 2 minutes 50 seconds, 3 minutes 25 seconds and 2 minutes 40 seconds respectively. F2 formulation showed less wetting time when compared to other four formulations. The results were reported in Table 10.

Nature of hair after wash

Nature of hair after wash was carried out with the help of application of herbal shampoo powders formulations (F1-F5) to volunteers. The volunteers observed the hairs as soft and manageable. The results were reported in Table 11.

DISCUSSION

The herbal shampoo powders were prepared by mixing in ascending order of with continuous trituration. F2 formulation exhibited satisfactory results with the evaluation parameters. It showed an increase in percentage foaming capacity in 1 hr amongst other formulations. An increase of about 33.2% in cleaning action and 192.2% in 60 minutes for perentage foaming capacity was noted. Quick action on wetting time of 2 minutes 30 seconds was reported. The similarity factor was noticed in the foaming capacity and nature of hair after wash for all the five formulations (F1-F5) of herbal shampoo powder.

CONCLUSION

F2 formulation of herbal shampoo powder was found to be in compliance with all the properties of powders and exhibited satisfactory results. The evaluation studies showed good cleaning action, better foaming capacity, and quick wetting time than other formulation batches. From the given study, it can be concluded that all the five formulations (F1-F5) of herbal shampoo powders prepared were good and had all the properties. Formulation F2 exhibited satisfactory results.

Table 8: The % foaming capacity of herbal shampoo powders

Time (minutes)	% Foaming capacity				
	F1	F2	F3	F4	F5
0	187.5	282.3	175.2	272.3	179.5
5	160.0	210.5	159.3	208.5	159.5
30	140.0	189.5	138.5	185.5	139.2
60	120.0	192.2	120.5	190.3	122.5
Average foaming capacity	151.8	218.6	148.3	214.15	150.17

Table 9: The dirt dispersion parameters of all the five formulations

Evaluation parameter	F1	F2	F3	F4	F5
Dirt dispersion	Moderate	Light	Light	Moderate	Moderate

Table 10: The evaluation parameters of wetting time of all the five formulations

Evaluation parameter	F1	F2	F3	F4	F5
Wetting time	3 minutes 10 seconds	2 minutes 30 seconds	2 minutes 50 seconds	3 minutes 25 seconds	2 minutes 40 seconds

Table 11: The evaluation parameters of nature of hairs after wash

Evaluation parameter	F1	F2	F3	F4	F5
Nature of hair after wash	Soft manageable	Soft manageable	Soft manageable	Soft manageable	Soft manageable

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