



Formulation Evaluation Poly-Herbal Shampoo Powder Hair Dye

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Abstract: In this study, we present the development and evaluation of an Polyherbal shampoo powder infused with natural dyes. The formulation incorporates a synergistic blend of botanical ingredients including indigo, Bhringraj, Beetroot, Methi, Neem, Shikakai, Reetha, Brahmi, Amla, Henna, and Bahera. The primary objective of this project is to create a natural alternative to conventional shampoos, utilizing the inherent properties of these botanicals to cleanse, nourish, and enhance hair health. Indigo, Beetroot, and henna are included for their traditionally recognized benefits in promoting hair growth and preventing premature graying & serves as a natural dye, imparting a subtle hue to the hair without the harshness of synthetic colourants. Methi and neem contribute antibacterial and antifungal properties, while Reetha and shikakai acts as a gentle cleanser. Brahmi, bhringraj and Amla are known for their hair-strengthening and conditioning effects, enhancing overall hair texture and shine. Bahera further complement the formulation with their conditioning and nourishing properties.

Objective: Formulate a Polyherbal shampoo powder with a blend of botanical ingredients known for cleansing, conditioning, and colouring properties. Incorporate Beetroot, Henna, Indigo, as a natural dye source for subtle and natural hair colouring. Enhance hair health and nourishment through the formulation's ingredients.

Methods: Drying, Weighing, Size reduction, Mixing, Sieving, Packing, and labeling

Results: Polyherbal shampoo powders that combine these herbs offer a holistic approach to hair care. They provide natural dyeing, strengthen hair, nourish the scalp, condition the hair, and maintain overall hair health. This combination of herbs leverages their individual benefits to create a comprehensive, natural, and effective hair care solution. Regular use of such polyherbal formulations can lead to healthier, stronger, and more vibrant hair without the side effects often associated with synthetic hair care products.

Conclusions: Polyherbal shampoo powders with natural dyes, including neelamari (*Indigofera tinctoria*), bhringraj (*Eclipta alba*), beetroot (*Beta vulgaris*), fenugreek (*Trigonella foenum-graecum*), neem (*Azadirachta indica*), shikakai (*Acacia concinna*), reetha (*Sapindus mukorossi*), brahmi (*Bacopa monnieri*), amla (*Phyllanthus emblica*), henna (*Lawsonia inermis*), and bahera (*Terminalia bellirica*), offer a holistic hair care solution. Indigo, Beetroot, and henna are included for their traditionally recognized benefits in promoting hair growth and preventing premature graying & serves as a natural dye, imparting a subtle hue to the hair without the harshness of synthetic colourants. Methi and Neem contribute antibacterial and antifungal properties, while Reetha and shikakai acts as a gentle cleanser. Brahmi, bhringraj and Amla are known for their hair-strengthening and conditioning effects, enhancing overall hair texture and shine. Bahera further complement the formulation with their conditioning and nourishing properties. This polyherbal blend ensures healthier, stronger, and more vibrant hair, utilizing the synergistic benefits of each herb to provide a natural and effective alternative to synthetic hair care products.



1. Introduction:

Poly herbal shampoo powder with dye is a unique blend of natural ingredients designed to provide comprehensive hair care, combining cleansing, nourishing, and colouring properties. This innovative product leverages the power of multiple herbs, each chosen for its specific benefits to hair health. Beetroot and henna are included for their traditionally recognized benefits in promoting hair growth and preventing premature graying & serves as a natural dye, imparting a subtle hue to the hair without the harshness of synthetic colourants. Methi and neem contribute antibacterial and antifungal properties, while Reetha and shikakai acts as a gentle cleanser. Brahmi, bhringraj and Amla are known for their hair-strengthening and conditioning effects, enhancing overall hair texture and shine. Bahera further complement the formulation with their conditioning and nourishing properties.

2. Methods:

Preparation of The Herbal Shampoo Powder:

Drying: All the powder are in dry form and grinded.

Weighing: All the required herbal powders for shampoo preparation were weighed individually.

Size reduction: The crude ingredients were collected and these ingredients were size reduced using hand driven mixer individually

Mixing: All these fine ingredients were mixed thoroughly by mixer to form a homogenous fine powder.

Sieving: Then this fine powder was passed through sieve no.:80, to get the sufficient quantity of fine powder.

Packing and labeling: Then it was packed and labeled suitably.

Formula:

Table No.1: Formula

Ingredient	Formulation
Fenugreek	0.5 gm
Neem	0.5 gm
Shikaki	1 gm
Reetha	0.5 gm
Brahmi	1 gm
Amla	1.5 gm

Heena	1.5 gm
Bahera	0.5 gm
Indigo	1 gm
Bhringraj	1 gm
Beetroot	1 gm

3. Characterization:

1) Organoleptic Evaluation: -

Organoleptic evaluation on the parameters like colour, odour and texture was carried out. Colour and texture were evaluated by vision and touch sensation respectively. For odour evaluation odour sensitive persons was formed and random sampling was performed.

2) General Powder Characteristic:

General powder characteristics includes evaluation of those parameters which are going to affect the external properties (like flow properties, appearance, packaging criteria etc.) of the preparation, Characteristics evaluated under this section are powder form, particle size, angle of repose and bulk density, tapped density, carrs index, hausner's ratio, Sample for all these evaluations were taken at three different level i.e. from top, middle and lower level.

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 calculated the calibration factor.

Calibration Factor= number of stage division/ Number of eyepiece division ×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 calculated by the following formula. It is expressed in g/cm³.

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

Were,

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 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/cm³. A volume of 100 ml graduated cylinder was taken and required amount of herbal shampoo powders 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

Tapped Density:

The tapped density is an increased bulk density attained after mechanically tapping a container containing the powder sample. After observing the initial powder volume or mass, the measuring cylinder or vessel is mechanically tapped for 1 min and volume or mass readings are taken until little further volume or mass change was observed. It was expressed in grams per cubic centimetre (g/cm³).

Tapped density = mass taken/bulk volume

Compressibility / Carr's Index:

Carr's index is used as indication of the compressibility of a powder. This is calculated using the formula;

Carr's index = Bulk density (Tapped) – Bulk density (Untapped) ÷ Bulk density (Tapped) × 100

Hausner's Ratio:

The hausners ratio is an indirect measure of the property of bulk material to reduce its volume under mechanical influence.it also measure of the ability to compress and of the interaction between the particles. This is calculated using the formula:

Hausner's Ratio = Bulk density (Tapped) / Bulk density (Untapped)

3) Physicochemical Evaluations:

Ash value:

This value is used to determine quality and purity of polyherbal shampoo powder with dye 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 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 vapours 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%.

Were,

(z-x) = weight of ash taken

Y= weight of drug taken

Determination of Acid Insoluble Ash:

Total ash obtained was boiled for 5 minutes with 25 ml of dilute hydrochloric acid and filtered the insoluble matter in a Gooch crucible, or on an ash less filter paper, washed with hot water and ignited to constant weight. The percentage of acid-insoluble ash was calculated for each sample.

Total acid insoluble ash value of the sample= a/y × 100

Were,

a= weight of acid insoluble ash taken

y= weight of drug taken

Determination of Water-Soluble Ash:

Determined in a similar way to acid insoluble ash, using 25 ml of water, in place of dilute HCL acid.

Total water-soluble ash value of the sample= a/y × 100

Were,

a= weight of acid insoluble ash taken

y= weight of drug taken



Moisture Content Determination:

10 g of polyherbal shampoo powder with dye formulations 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.

Total moisture content of the sample= $a/y \times 100$

Were,

a= weight of moisture content

y= weight of drug taken

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. 1 g each of polyherbal shampoo powder with dye formulations 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 polyherbal shampoo powder with dye formulations 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:

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

Were,

DP=the percentage of detergency powder

C= the weight of sebum in control sample

T=the weight of sebum in test sample

Foaming Index:

2 g of polyherbal shampoo powder with dye formulations 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 formulations after 1 minute shaking and % foaming capacities of all the five formulations for a time of 60 minutes were performed. It can be calculated by using formula

$$\text{Foaming Index} = 1000/a$$

Were,

a=volume in ml of the decoction in the test tube showing

one cm foaming height

Dirt Dispersion:

Two drops of 1% polyherbal shampoo powder with dye formulations 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.

Wetting Time:

A canvas was taken and cut into 1 inch diameter discs. The discs were floated on the surface of formulations of 1% polyherbal shampoo powder with dye solution and time was noted. The time required for the disc to begin to sink was measured accurately and noted as wetting time.

Washability:

Little quantity of scrub was applied over the skin & was washed with water it absolutely was easily washable.

Water Soluble Content in Shampoo:

Solubility indicates the utmost amount of a substance that may be dissolved in an exceedingly solvent at a given temperature. Such an answer is termed saturated. Divide the mass of the compound by the mass of the solvent and so multiply by 100 g to calculate the solubility in g/100g.

Colour Test:

Prepared Polyherbal shampoo powder with dye was tested for colour testing. The test was performed on white cat and checked whether colour is absent or present.

Skin Irritation Test:

Prepared Polyherbal shampoo powder with dye was tested for skin irritation test. The test was performed on skin of hand of volunteers and check whether its irritation on skin was absent or present.

4. Results:

1) Organoleptic Evaluation:

The result was the visual inspection of the formulation were listed in the following table. As can be seen, the formulated shampoo powder with dye had the good organoleptic evaluation and is listed in table.



Table No.2: Organoleptic evaluation

Sr. No.	Parameter	Observation
1	Colour	Yellowish Brown
2	Odor	Characteristics
3	Texture	Smooth

2) General Characteristics:

Particle size:

For the determination of particle size calibration factor was determined and it was found to be 2.8 μm with the help of calibration factor. the average particle size of polyherbal shampoo powder with dye was found to be 11.088 μm



Figure No.1: Particle Size

Angle of Repose:

The angle of repose of polyherbal shampoo powder with dye was calculated with the help of fixed funnel method and it was found to be 38.30.

$$\text{Angle of repose} = \Theta = \tan^{-1} (h/r)$$

Were,

h= Height of the pile formed.

r = the radius of the base of pile

$$\begin{aligned} \text{Angle of repose} &= \Theta = \tan^{-1} (h/r) \\ &= \tan^{-1} (2/2.53) \\ &= \tan^{-1}(0.790) \\ &= 38.30 \end{aligned}$$

The angle of repose 38.30 it indicates that good flowability of polyherbal shampoo powder with dye

Bulk density:

Bulk density of polyherbal shampoo powder with dye was calculated with cylindrical method and bulk apparatus and it was found to be 1.02 gm/cm^3 .

$$\begin{aligned} \text{Bulk density} &= \text{mass}/\text{volume} \\ &= 5/4.9 \\ &= 1.02 \text{ gm}/\text{cm}^3 \end{aligned}$$

Tapped density:

Tapped density of polyherbal shampoo powder with dye was calculated with the help of cylindrical method and it was found to be 1.13 gm/cm^3 .

$$\begin{aligned} \text{Tapped density} &= \frac{\text{mass taken}}{\text{tapped volume}} \\ &= 5/4.4 \\ &= 1.13 \text{ gm}/\text{cm}^3 \end{aligned}$$

Carr's index:

Carr's index of polyherbal shampoo powder with dye was calculated with the help of tapped density and bulk density and it was found to be 9.73

$$\begin{aligned} \text{Carr's index} &= \frac{\text{tapped density} - \text{bulk density}}{\text{tapped density}} \times 100 \\ &= \frac{1.13 - 1.02}{1.13} \times 100 \\ &= 9.73 \end{aligned}$$

Carr's index 9.73 it indicates that excellent flowability of polyherbal shampoo powder with dye

Hausner ratio:

Hausner ratio of polyherbal shampoo powder with dye was calculated with the help of tapped density and bulk density and it was found to be 1.10

$$\begin{aligned} \text{Hausner ratio} &= \frac{\text{tapped density}}{\text{bulk density}} \\ &= \frac{1.13}{1.02} \\ &= 1.10 \end{aligned}$$

Hausner ratio 1.10 it indicates that excellent flowability of polyherbal shampoo powder with dye

3) Physicochemical Evaluations:

Ash Value:

Ash value is used to determine the quality and purity of polyherbal shampoo powder with dye and it was found to be 3% w/w.

$$\text{Total ash value of the sample} = \frac{100(z-x)}{y}\%$$

Were,

(z-x) = weight of ash taken

Y= weight of drug taken

$$\begin{aligned} \text{Total ash value of the sample} &= \frac{100(z-x)}{y} \\ &= \frac{100(0.06)}{2} \\ &= 3\% \text{ W/W} \end{aligned}$$

Ash Value 3% w/w it indicates that quality and purity of polyherbal shampoo powder with dye.

Acid Insoluble Ash:

Acid insoluble ash value measures of inorganic content of polyherbal shampoo powder with dye.it provides the



information of purity of polyherbal shampoo powder with dye and allows the comparison between different samples and it was found to be 1% w/w.

Total acid insoluble ash value of the sample= $a/y \times 100$

Were,

a= weight of acid insoluble ash taken

y= weight of drug taken

Total acid insoluble ash value of the sample= $a/y \times 100$

$$=0.02/2 \times$$

100

$$=1\% \text{ w/w}$$

Acid insoluble ash value 1% w/w it indicates that inorganic content and purity of polyherbal shampoo powder with dye.

Water Soluble Ash:

Water soluble ash value measures the portion of total ash that is soluble in water, which can provide information about the presence of water-soluble minerals, salts and it was found to be 3.5% w/w.

Total water-soluble ash value of the sample= $a/y \times 100$

Were,

a= weight of acid insoluble ash taken

y= weight of drug taken

Total water-soluble ash value of the sample= $a/y \times 100$

$$=0.07/2 \times$$

100

$$=3.5\% \text{ w/w}$$

Water soluble ash value 3.5% w/w it indicates that presence of water soluble minerals and salts of polyherbal shampoo powder with dye.

Moisture Content:

Moisture content which helps ensures the polyherbal shampoo powder with dye free-flowing, avoids clumping and maintain its stability and effectiveness during storage and it was found to be 4.66%.

Total moisture content of the sample= $a/y \times 100$

Were,

a= weight of moisture content

y= weight of drug taken

Total moisture content of the sample= $a/y \times 100$

$$=0.07/1.5 \times 100$$

$$=4.66\%$$

Moisture content 4.66% indicates that the polyherbal shampoo powder with dye free-flowing, avoids clumping

and maintain its stability and effectiveness during storage.

pH:

pH of polyherbal shampoo powder with dye was found to be 5.03. it can be measured by pH meter.



Figure No.2: pH Value

Cleaning Action:

Cleaning action of polyherbal shampoo powder with dye was found to be 31.060%.

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

Were,

DP = the percentage of detergency power,

C = the weight of sebum in the control sample,

T = the weight of sebum in the test sample.

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

$$= 100 (1-18.2/26.4)$$

$$= 31.060\%$$

Cleaning action 31.060% it indicates that good cleaning action of polyherbal shampoo powder with dye.



Figure No.3: Cleaning Action

Foaming Index:

foaming index indicates the capability of a substance to form

a foam, trapping the air or gas in a liquid or solid matrix. This



is important for accessing surfactant, proteins and other foaming agents and it was found to be 250%.

Table No.3: Foaming Index

Formulation	Height of foam
1ml	0.1cm
2ml	0.2cm
3ml	0.7cm
4ml	0.9cm
5ml	0.8cm
6ml	0.6cm
7ml	0.5cm
8ml	0.4cm
9ml	0.3cm
10ml	0.5cm

Foaming Index= 1000/a

Were,

a= volume in ml of the decoction in the test tube showing one cm foam height

Foaming index=1000/a

=1000/4

=250%

Foaming index 250%% it indicates that good foaming index of polyherbal shampoo powder with dye.



Figure No.4: Foaming Index

Dirt Dispersion:

Dirt dispersion is an important criterion for evaluation the cleansing action of shampoos and ink foam was found to be moderate.



Figure No.5: Dirt Dispersion

Wetting Time:

Wetting time is a crucial test for polyherbal shampoo powder with dye to evaluate how quickly the powder become wet and ready for use and it can found to be 6 seconds.



Figure No.6: Wetting Time

Washability:

Washability is important test to check the washing action of shampoo which should remove the grease and dirt particles from the scalp and hair fibres. This herbal shampoo shows a good washability with easily removal of the grease and dirt particles.

Water Soluble Content In polyherbal Shampoo powder with dye:

Water soluble content in polyherbal shampoo powder with dye was found to be 5% and which can show good water-soluble content in polyherbal shampoo powder with dye

Weight of filter paper with sample (solute) = 5gm

Solvent=100

Total percentage of water-soluble content = solute/solventx100

= 5/100x100

= 5%



Figure No.7: Water Soluble Content

Colour test:

10 gm of polyherbal shampoo powder with dye was applied on white cat and after 5-6 minutes it is washed and it shows brown colour and the colour stays for 4-5 days.



Day 1

Day 2



Day 3

Day 4



Day 5

Figure No.8: Colour Test

Skin Irritation Test:

Polyherbal shampoo powder with dye was tested for skin irritation test. The test was performed on skin of hand of volunteers and its irritation on skin was absent.



Figure No.9: Skin Irritation Test

5. OBSERVATION TABLE:

1) Organoleptic Evaluation:

Table No.4: Organoleptic Evaluation Test

Evaluation test	Observation
Colour	Yellowish brown
Odor	Characteristics
Texture	Smooth

2) General Powder Characteristics:

Evaluation test	Observation
Particle size	11.088 µm



Angle of repose	38.3
Bulk density	1.02gm/cm ³
Tapped density	1.13 gm/cm ³
Carr's Index	9.73
Hausner ratio	1.1

Table No.5: General Powder Characteristics Test

3) Physicochemical Evaluation:

Evaluation test	Observation
Ash value	3% W/W
Acid insoluble ash value	1% W/W
Water soluble ash value	3.5% W/W
Moisture content	4.66%
pH	5.03
Cleaning action	31.06%
Foaming Index	250%
Dirt dispersion	Moderate
Wetting time	6 second
Washability	Good washable
Water soluble content	5%
Colour test	Brown
Skin irritation test	No irritation

Table No.6: Physicochemical Evaluation Test

6. Conclusion:

Polyherbal shampoo powders with natural dyes, including Neelamari (*Indigofera Tinctoria*), Bhringraj (*Eclipta Alba*), Beetroot (*Beta Vulgaris*), Fenugreek (*Trigonella Foenum-Graecum*), Neem (*Azadirachta Indica*), Shikakai (*Acacia Concinna*), Reetha (*Sapindus Mukorossi*), Brahmi (*Bacopa Monnieri*), Amla (*Phyllanthus Emblica*), Henna (*Lawsonia Inermis*), And Bahera (*Terminalia Bellirica*), offer a holistic hair care solution. Indigo, Beetroot and henna are included for their traditionally recognized benefits in promoting hair growth and preventing premature graying & serves as a natural dye, imparting a subtle hue to the hair without the harshness of synthetic colourants. Methi and Neem contribute antibacterial and

antifungal properties, while Reetha and shikakai acts as a gentle cleanser. Brahmi, bhringraj and Amla are known for their hair-strengthening and conditioning effects, enhancing overall hair texture and shine. Bahera further complement the formulation with their conditioning and nourishing properties. This polyherbal blend ensures healthier, stronger, and more vibrant hair, utilizing the synergistic benefits of each herb to provide a natural and effective alternative to synthetic hair care products.

Poly herbal shampoo powders that combine these herbs offer a holistic approach to hair care. They provide natural dyeing, strengthen hair, nourish the scalp, condition the hair, and maintain overall hair health. This combination of herbs leverages their individual benefits to create a comprehensive, natural, and effective hair care solution. Regular use of such poly herbal formulations can lead to healthier, stronger, and more vibrant hair without the side effects often associated with synthetic hair care products.

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