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Research Article

Formulation and Evaluation of Polyherbal Powder Shampoo Using Indian Medicinal Plants

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Abstract

Herbal cosmetics are products made with phytochemicals derived from various plant sources, which influence skin functions and supply nutrients for healthy skin or hair. The most popular method of hair care is shampooing, which involves removing contaminants from the hair, including dandruff, oils, grime, skin particles, and other contaminants that accumulate over time. Shampoos are hair care products. Synthetic cosmetics used in hair products have a number of negative side effects, including ocular toxicity, excessive hair drying, salt buildup on the hair shaft, etc. Making a comprehensive herbal shampoo in powder form is thus a difficulty. This study aims to formulate and evaluate powder shampoo which are then compared with marketed powder shampoo. Six preparations of herbal shampoo powder were formulated using some common traditional drugs used by folk and traditional people for hair care. The preparations were formulated using Amla fruit, Neem leaf, Hibiscus leaf, Shikakai fruit, Ritha fruit, Fenugreek and Orange peel evaluated for organoleptic, powder characteristics physicochemical evaluation, foaming capacity, washability, wetting time, dirt dispersion, cleaning action, skin irritation test and stability study to ensure its safety and efficacy. The combination of several such ingredient of herbal origin has made it possible to secure highly effective dry powder shampoo. After complete study it concluded that all the six formulations shown good qualities of shampoo as compared to marketed formulation. Whereas the formulation B shows more ideal properties when compared with other five. As the formulation is in the powdered form, it has low risk during storage as compared to liquid shampoo. Also, the formulation is cheapest, easily applied on the hair and have low risk of side effects. The pH of the polyherbal shampoo range to be 5.45, which was near to the skin ph. The foaming capacity of shampoo was found to be good foaming.

Keywords: Herbal cosmetics, hair cosmetics, powder shampoo, formulation & evaluation.

Introduction

Traditional system of medicine continues to be widely practiced on many accounts. Population rises, inadequate supply of drugs, prohibitive cost of treatments, side effects of several

synthetic drugs and development of resistance to currently used drugs for infectious diseases have led to increased emphasis on the use of plant

materials as a source of medicines for a wide variety of human ailments¹.

Ayurveda which literally means knowledge (*Veda*) of life (*Ayur*) had its beginning of *Atharvaveda*. *Charak Samhitha* and *Sushruta Samhitha* are the two most famous treaties of Ayurveda. Vegetable products dominated Indian *Materia Medica* which made extensive use of bark, leaves, flower, fruit, root, tubers and juices³. The theory of *rasa*, *vipaka*, *viry* and *prabhava* formed the basis of Ayurveda pharmacology, which made no clear distinction between diet and drug, as both were component of treatment. *Charak*, *sushruta* and *vagbhata* described 700 herbal drugs with their properties and clinical effects.

Herbal cosmetics

Herbal cosmetic also known as "natural cosmetics". The demand of herbal medicines is increasing rapidly due to their lack of side effects. With the beginning of the civilization; humankind had the attractive plunge towards impressing others with their looks. At the time, there were no fancy fairness creams or any cosmetic surgeries. To begin with just thing, they had was the information of nature, aggregated in the Ayurveda. With the art of Ayurveda, a few herbs and floras were used to make Ayurvedic cosmetics that truly worked. Ayurvedic cosmetics not only beautified the skin but acted as the shield against any kind of external affects for the body. Ayurvedic cosmetics also known as the herbal cosmetics have the same admirable resources in the present-day period too⁴.

Indian extracts for herbal cosmetics⁴

Herbs assume a significant role, especially in present day times, when the harming effects of food processing and overmedication have accepted alarming proportions. They are currently being progressively cosmetics, foods and teas, as well as alternative medicines. The developing enthusiasm for herbs is a part of the development towards change in the ways of life. This development depends on the conviction that the plants have a tremendous potential for their utilization as a remedial medication.

Amla (*Embilica officinalis*): Amla grows throughout India and the name given to the fruit of a small leafy tree (*Embilica Officinalis*). This

fruit have a high content of vitamin C which is extracted from its seeds it is used as a treatment for hair and scalp problem.

Shikaka (*Acasia cancina*): It is a small shrub-like tree, which grows in the warm, dry plains of central India. It helps in removing dandruff and lice & very effective in removing oil and dirt from hair.

Neem (*Azadirachata indica*): "Sarva Roga Nivarini - the curer of all ailments" Neem's role as a wonder drug is stressed as far back as 4500 years ago. Some of its health benefits include immunity booster, effective in skin infection, blood purifier etc.

Reetha Powder (Soap nut): It is used in India as a natural hair and body cleanser.

Hair care products

Hair-care products may be defined as the preparations which are used for cleansing hair and scalp, modifying the texture and giving the healthy look to the hair. There are various types of hair: normal hair, oily hair, dry hair, varies from one human to another human. The problems of hairs include hair falling, white hair, dandruff, and split end hair etc. The reasons of hair problem are tension, scalp infection, hormones disturbances, food and large chemical shampoo use. In this direction, we are presenting here polyherbal shampoo which is used as a multipurpose for hair treatment with fewer side effects in a daily life⁵.

Hair

Hair or pili are growths of the epidermis which are present over almost the complete body. they're however absent only from the perimeters and Palmar surfaces of the hands, sides and plantar surfaces of the feet, the lips and also the region round the urogenital orifices¹⁰. A hair consists of columns of dead and keratinized cells joined together. The shaft is that the superficial portion of the hair, which projects from the surfaces of the skin. The shaft of straight hair is round in cross /section, that of wavy hair is oval which of woolly hair is elliptical or kidney shaped.

Anatomy and physiology of the hair

Structure of Hair

A hair is made up of welded columns of dead, keratinized cells. The shaft is the visible part of the hair that protrudes from the skin's surface.

Straight hair has a spherical cross section, wavy hair has an oval cross section, and woolly hair has an elliptical or kidney shape. The root is the deep section of the hair that penetrates into the dermis and sometimes into the subcutaneous layer. Both the shaft and the root are made up of three concentric layers-Medulla: It is the central part of the shaft and is generally noticeable in thick hair. It is composed of two or three rows of polyhedral cells containing pigment granules and air spaces.

Cortex: It is located peripheral to the medulla and forms the major part of the shaft. It consists of elongated cells, containing pigment granules in dark hair while air in white hair.

Cuticle: It is the outermost layer of the hair and consists of a single layer of thin, flat cells, which are heavily keratinized¹⁰

Physiology of the hair

Hair follicles grow in cycles that alternate between fast growth and hair shaft formation and apoptosis-driven hair and relative hair follicle quiescence. The hair growth cycle, in particular, can be separated into three main phases: 1) Anagen or growth phase
2) Catagen or transitional phase and
3) Telogen or resting phase

The anagen phase is an active growth phase, during which the hair follicle enlarges reaching its characteristic onion shape and a hair fiber is produced. It can be divided into six stages (I–VI). During anagen I–V (proanagen), hair progenitor cells proliferate, envelope the growing dermal papilla, grow downwards into the skin, and begin to differentiate into the hair shaft and IRS; then, the newly formed hair shaft begins to develop and the melanocytes located in the hair matrix show pigment producing activity; in anagen VI (metanagen), full restoration of the hair fiber-producing unit is realized, which is characterized by formation of the epithelial hair bulb surrounding the dermal papilla, located deep in the subcutaneous tissue, and the new hair shaft appears from the skin surface¹¹. This phase can last for several years in hair follicles.

Shampoo

Shampoos are probably the most widely used hair products today, based on synthetic ingredients as well as herbal ingredients. A

shampoo is a preparation of a surfactant (i.e., surface active material) in a suitable form – liquid, solid or powder – which when used under the specified conditions will remove surface grease, dirt, and skin debris from the hair shaft and scalp without adversely affecting the user.

Herbal shampoo

Herbal shampoos are the cosmetic preparations that with the use of traditional ayurvedic herbs are meant for cleansing the hair and scalp just like the regular shampoo. They are used for removal of oils, dandruff, dirt, environmental pollutions etc.

Ideal properties of shampoo

Nowadays shampoo formulations are beyond the stage of pure cleansing of the hair. Additional benefits are expected, e.g, conditioning, smoothing of hair surface, improvement of comb ability and leather creaminess.

1. It should effectively and completely remove dust or soil, excessive sebum or other fatty substances and loose corneal cells from the hair.
2. It should produce a good amount of foam to satisfy the psychological requirements of the user.
3. It should be easily removed on rinsing with water.
4. It should leave the hair non-dry, soft, lustrous with good manageability and minimum fly away.
5. It should impart a pleasant fragrance to the hair.
6. It should not cause any side-effects and irritation to skin or eye.
7. It should not make the hand rough and chapped.
8. To deliver an optimum level of foam to satisfy the expectation of the user.
9. To perform as a vehicle for the deposition of beneficial materials onto the hair and scalp.
10. To be non-damaging to the tissues of the eye if inadvertently splashed

Advantages

- Stable on storage
- Easy to carry
- No spillage
- Reduce the side effects¹⁵

Methodology

Plant collection and authentication

The sample was collected from Thrissur; marottichal and meloor locality. The plant material was authenticated by the Botanist Anto PV (assistant professor), Research department of Botany, St Thomas college, Thrissur. The plant materials were dried under shade for few days, powdered with mechanical grinder, sieved and stored in an air tight container.

Preparation of herbal powder shampoo

- ★ Drying of ingredients
- ★ Size reduction
- ★ Sieving
- ★ Weighing
- ★ Mixing
- ★ Storage

Drying of ingredients

Water is traditionally removed through evaporation by using methods such as air drying, sun drying, smoking or wind drying. Dry the plant materials under shade at room temperature (25 -30°C). There may have some photosensitive materials, so direct sunray is not the recommended way to dry the same.

Size reduction

Size reduction is a process in which the particle size of a solid is made smaller. The term size reduction is applied to ways in which particles of solids are cut or broken into smaller pieces. Size reduction is necessary if the starting material is too coarse, and the final product needs to be a fine powder.

sieving

Sieving is a process by which fine particles are separated from bigger particles by using a sieve. It also helps to achieve uniform particle size.

Weighing

Weighing raw materials for a product is a time taking process. After all, the desired effect of the product depends on the right balance of each raw material. All raw materials are therefore weighed responsibly and accurately, on the basis of formulation.²⁰

mixing

Mixing has been defined as the intermingling of two or more dissimilar portions of a material, resulting in the attainment of a desired level of uniformity, either physical or chemical, in the

final product. Three basic rules for mixing pharmaceutical powders.

Storage

When storing herbal powders, keep in air tight containers. They need to stay extra air tight so no moisture can get in, and they are less exposed to oxidation. Timeline of expiration: alcoholic based tinctures last the longest (about 1-3 years); dried herbs for tea (when stored well) can last for up to 6-7 months.

organoleptic evaluation

Organoleptic evaluation can be done by means of organs of sense. This refers to the evaluation of drug by colour, odour, size, shape, and special features including touch, texture etc. However, the judgement based on the sensory characteristics like odour, taste, etc. May vary from person to person and time to time based on individual's nature.

powder characteristics

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 particle size, angle of repose, bulk density and tapped density. All the three shampoo powders took at three different level i.e., from top, middle and lower level for the evaluation.

particle size

particle size is a parameter, which affect various properties like spreadability, grittiness etc., particle size was determined by sieving method using i.p. standard sieves by mechanical shaking for 10 min.

angle of repose

it is defined as the maximum angle possible in between the surface of pile of powder to the horizontal flow.

The angle of repose (θ) can be calculated by using the formula.

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

Bulk density

bulk density is the ratio between the given mass of a powder and its bulk volume. Required amount of the powder is dried and filled in a 50 ml measuring cylinder up to 50 ml mark. Then the cylinder is dropped onto a hard wood surface from a height of 1 inch at 2 second intervals. The

volume of the powder is measured. Then the powder is weighed. This is repeated to get average values

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/cm^3)¹⁸.

physiochemical evaluation

determination of moisture content

Five grams of the powdered aerial parts of plant were placed in tared evaporating dish. Drying was carried out at 105°C for five hours. The drying was continued with intermittent weighing at one-hour interval until difference between two successive weighing was not more than 0.25%. Constant weight was reached when the two-consecutive weighing after drying for 30 minutes and cooling for 30 minutes in desiccator, showed not more than 0.01 gm difference.

determination of extractive values

This method determines the number of active constituents in each amount of plant material when extracted with solvent. For example, lowering from the prescribed

Values indicate the addition of exhausted or unwanted material with original rug or in correct processing of the drug.

Alcohol soluble extractive value

Macerated 5 grams powdered shampoo with 100 ml ethanol in a stoppered flask for 24 hours, with occasional shaking during the first 6 hours and allowed to stand undisturbed for another 18 hours. Filtered rapidly, by taking precautions against loss of alcohols. The 25 ml of the filtrate was evaporated to dryness in a tared flat-bottomed shallow dish, dried at 80°C and weighed. Calculated w/w ethanol soluble extractive with reference to air dried material.

Water soluble extractive value

Macerated 5 grams of powder shampoo with 100 ml water in a stoppered flask for 24 hours, with occasional shaking during the first 6 hours and allowed to stand undisturbed for another 18

hours. Filtered rapidly, then 25 ml of the filtrate was evaporated to dryness in a tared flat-bottomed shallow dish, dried at 105°C and weighed. Calculated w/w ethanol soluble extractive with reference to air dried material.

Determination of ph

the ph of 10% shampoo solution in distilled water was determined at room temperature 25°C. The ph was measured by using digital ph meter.

evaluation of foreign matter

about 100-200 gm of powder to be examined was weighed and spread out in a thin layer. The foreign matter was detected. It was separated, weighed and the percentage of foreign matter was calculated.

foaming capacity

Cylinder shake method was used for determining foaming ability. 50 ml of the 1% shampoo solution was put into a 250 ml graduated cylinder and covered the cylinder with hand and shaken for 10 times. The total volumes of the foam contents after 1 minute shaking were recorded. The foam volume was calculated only. Immediately

After shaking the volume of foam at 1-minute intervals for 4 minutes was recorded for all the three shampoo powders.

Dirt dispersion

Two drops of 1% each shampoo powders were added in a large test tube contain 10 ml of distilled water. 1 drop of india ink was added; the test tube was stoppered and shaken for 10 times. The amount of ink in the foam of was estimated as none, light, moderate, or heavy.

wetting time

The canvas was cut into 1 inch diameter discs having an average weight of 0.44 g. The disc was floated on the surface of shampoo solution of 1% w/v and the stopwatch started. The time required for the disc to begin to sink was measured accurately and noted as the wetting time.

nature of hair after washes

nature of hair after wash can be done by collecting the responses of volunteers. Stability study.

Cleaning action

5 grams of wool yarn were placed in grease, after that it was placed in 200 ml. Of water containing 1 gram of each polyherbal shampoo

powder in a flask. temperature of water was maintained at 35^oc. The flask was shaken for 4 minutes at the rate of 50 times a minute. The solution was removed and sample was taken out, dried and weighed. the amount of grease removed was calculated. In which, dp is the percentage of detergency power, c is the weight of grease in the control sample and t is the weight of grease in the test sample.

Solubility

Solubility indicates the utmost amount of a substance that may be dissolved in a solvent at a

given temperature. Resultant solution 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.

Stability study

The thermal stability of the shampoos was studied by placing them in glass tubes in a humidity chamber at 45^oc with 75% ratio also as in an exceedingly refrigerator at 4^oc, and comparing them to the identical shampoos kept at a space temperature of 25 ^oc.

Formula for polyherbal powder shampoo

Ingredients	F1	F2	F3	F4	F5	F6
Amla	12.5	8	10	13.5	9	14.5
Neem	13.5	14.5	15.5	12.5	10	8
Hibiscus	14	13.5	9	15.5	15.5	12.5
Methi	15.5	14	16.5	14	13.5	17
Orange peel	18.5	12.5	13.5	11.5	16.5	13.5
Soap nut	14.5	20.5	16.5	18.5	19	14
Shikakai	11.5	17	19	14.5	16.5	20.5

Biological source and their use of herbal ingredients

Constituents	Biological source /family	uses
Amla fruit	Dried ripe fruit of emblica officinalis (euphorbiaceae)	Darkening of hair and hair promoter
Neam leaf	Dried leaves of azadiracta indica (Miliaceae)	Prevent dryness of hair and flaking of hair
Hibiscus leaf	Dried leaves of hibiscus rosea(Malvaceae)	Prevent hair loss and hair growth promoter
Shikakai fruit	Dried pods of acacia concinna(Mimosaceae)	Foam base and antidandruff
Ritha fruit	Dried fruits of sapindus mukorossi(Sapindaceae)	Detergent and ant dandruff
fenugreek	Dried seeds of trigonella foenum graecum (Fabaceae)	Reduces hair fall,treat dandruff,and split ends
Orange peel	Dried peels of citrus reticulata	Control oil balance ,antibacterial ,antioxidant

Results and Discussion

Plant Collection

The plant *azadirachta indica*, *hibiscus rosa-sinensis*, *acacia sinuate*, *sapindus trifoliatus*, *citrus reticulata*, *Phyllanthus emblica* was collected from market and wash under running water to remove contaminants

Organoleptic Evaluation

The result of organoleptic evaluation parameters like colour, odour and texture revealed that the formulation F1 to F6 and marketed product was fine and smooth. The colour, odour and taste of formulation F1 to F6 and marketed product was Brownish, Slight and characteristics. all formulations had the good characteristics with respect to foaming.

Test	F1	F2	F3	F4	F5	F6
Colour	Slightly brownish	Greenish brown	Greenish brown	Greenish brown	Slightly greenish	Brownish
Odour	Aromatic herbal odour	Aromatic herbal odour	Aromatic herbal odour	Aromatic herbal odour	Aromatic herbal odour	Aromatic herbal odour
Texture	Fine and smooth	Fine and smooth	Fine and smooth	Fine and smooth	Fine and smooth	Fine and smooth

General powder characteristics

General powder characteristics study showed that the particle size of powder formulation F1 to F6 and marketed product was found to be in ranges of 20 to 25 μ m.

Angle of Repose

Good flow property is essential in formulation of any powder. The angle of Repose of formulation F1 to F6 and marketed product was found to be 24.30, 22.48, 24.18, 24.55, 23.56, 24.10 and 24.45.

Tapped density

Tapped density of herbal powder formulation F1 to F6 and marketed product was found to be 0.38g/m³, 0.35g/m³, 0.34g/m³, 0.39g/m³, 0.20g/m³, 0.28g/m³ and 1.39g/m³.

Bulk density

The bulk density of herbal powder formulation F1 to F6 and marketed product was found to be 0.24g/m³, 0.32g/m³, 0.32g/m³, 0.39g/m³, 0.20g/m³, 0.28g/m³ and 1.15g/m³. This measurement indicates that the loose powder packing may be to the presence of large inter-particle spaces.

Test	F1	F2	F3	F4	F5	F6
Particle size	20-25 μ	20-25 μ	20-25 μ	20-25 μ	20-25 μ	20-25 μ
Angle of repose	24.30	22.48	24.18	24.55	23.56	24.10
Bulk density	0.24g/m ³	0.32g/m ³	0.32g/m ³	0.26g/m ³	0.28g/m ³	0.31g/m ³
Tapped density	0.35g/m ³	0.34g/m ³	0.35g/m ³	0.39g/m ³	0.20g/m ³	0.28g/m ³

Physicochemical Evaluations

Extractive value

The extractive value of the parts of the plant (both alcohol soluble and water soluble) were determined as per method given in the earlier. The alcohol soluble extractive value of the parts of the plants was found to be more than that of water-soluble extractive value. This may due to the presence of non-polar constituents.

The water-soluble extractive value of herbal formulation F1 to F6 and marketed product was found to be 12.48%w/w, 12.58%w/w, 12.13%w/w, 12.13%w/w, 11.14%w/w, 13.14%w/w and 14.45%w/w.

The alcohol soluble extractive value of herbal formulation A to F and marketed product was found to be 16.70%w/w, 17.19%w/w, 16.50%w/w, 15.58%w/w, 17.01%w/w, 16.17%w/w and 16.23%w/w respectively.

Test	F1	F2	F5	F4	F5	F6
Extractive value alcohol soluble	16.70 w/w	17.19 w/w	16.70 w/w	15.58w/w	17.01 w/w	16.17 w/w
Extractive value water soluble	12.48w/w	15.58 w/w	12.13 w/w	12.13 w/w	11.14 w/w	13.14 w/w

Moisture content

The moisture content study shows that in herbal formulation F1 to F6 and marketed product range from 2.80%,3.00%,2.90%,3.14%,2.95%,3.10% and 4.3% respectively.

Test	F1	F2	F3	F4	F5	F6
Moisture content	2.80%	3.00%	2.90%	3.14%	2.95%	3.10%

Determination of pH

The pH of shampoos has been shown to be important for improving and enhancing the qualities of hair, minimizing irritation to the eyes and stabilizing the ecological balance of the scalp. pH range is one of the ways to minimize damage to the hair. PH of the shampoo powder formulation F1 to F6 and marketed product was found to be 5.6,4.9,5.4,5.1,4.6,5.2 and 4.3 which signifies that herbal shampoo shall be non-irritating to the skin.

Test	F1	F2	F3	F4	F5	F6
pH	5.6±0.05	4.9±0.02	5.4±0.03	5.1±0.04	4.6±0.02	5.2±0.03

Foreign matter

According to foreign matter study done in formulation F1 to F6 and marketed product range from 0.293%,0.284%,0.287%,0.267%,0.291%,0.251% and 0.12% respectively.

Test	F1	F2	F3	F4	F5	F6
Foreign matters	0.293%	0.284%	0.287%	0.267%	0.291%	0.251%

Comparison of Physicochemical Evaluation

Test	F1	F2	F3	F4	F5	F6
Extractive value alcohol soluble	16.70 w/w	17.19 w/w	16.70 w/w	15.58w/w	17.01 w/w	16.17 w/w
Extractive value water soluble	12.48w/w	15.58 w/w	12.13 w/w	12.13 w/w	11.14 w/w	13.14 w/w
Moisture content	2.80%	3.00%	2.90%	3.14%	2.95%	3.10%
pH	5.6±0.05	4.9±0.02	5.4±0.03	5.1±0.04	4.6±0.02	5.2±0.03
Foreign matter	0.293%	0.284%	0.287%	0.267%	0.291%	0.251%

Foaming capacity

These results showed that the powder which is capable to produce high foaming property. This is due to the presence of soap nut is used as foaming agent which mainly consists of sapindoside A and B. Foaming capacity of formulation F1 to F6 and marketed product shows that good foaming,v.good foaming, mild foaming, good foaming, mild foaming, mild foaming and good foaming.

Test	F1	F2	F3	F4	F5	F6
Foaming capacity	Good foaming	Good foaming	Good foaming	Good foaming	Good foaming	Good foaming

Washability

Formulations were applied on the skin and then ease and extent of washing with water were checked manually. The washability studies done in all formulation F1 to F6 and marketed product shows that easily washable.

Test	F1	F2	F3	F4	F5	F6
Washability	Easily washable	Easily washable	Easily washable	Easily washable	Easily washable	Easily washable

Nature of Hair after wash

Nature of hair after wash was carried out the with the help of application to the hairs of volunteers. The volunteers observed the hairs as soft and manageable. The nature of hair after wash in formulation F1 to F6 and marketed product was found to be soft manageable.

Test	F1	F2	F3	F4	F5	F6
Nature of the hair after wash	Soft and manageable	Soft and manageable	Soft and manageable	Soft and manageable	Soft and manageable	Soft and manageable

Wetting time

Wetting time of a substance is a function of its concentration. The wetting time of formulation F1 to F6 and marketed product was found to be 1min58sec, 1min52sec, 2min,59sec, 1min15sec 1min30sec, 56sec respectively.

Test	F1	F2	F3	F4	F5	F6
Wetting time	1Min 27sec	1Min 20sec	1Min 24sec	59sec	1Min 15sec	1Min 30sec

Dirt dispersion

Shampoo that causes the ink to concentrate in the foam is considered poor quality, the dirt should stay in water. Dirt that stays in the foam will be difficult to rinse away. It will redeposit on the hair. All shampoos showed similar results.

These results indicate that no dirt would stays in the foam; so prepared and marketed formulations are satisfactory. Dirt dispersion in formulation F1 to F6 and marketed product was moderate.

Test	F1	F2	F3	F4	F5	F6
Dirt dispersion	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate

Solubility

The solubility test revealed that the powder shampoo powder comprises of mostly soluble ingredients which may be helpful in producing comfortable feeling while being mixed with water. The herbal powder shampoo formulation F1 to F6 and marketed product was sparingly soluble in water

Test	F1	F2	F3	F4	F5	F6
Solubility	Soluble with water	Soluble with water	Soluble with water	Soluble with water	Soluble with water	Soluble with water

Cleaning action

Cleaning action was tested on wool yarn in grease. Although cleaning or soil/sebum removal is the primary aim of a shampoo, experimental detergency evaluation has been difficult to standardize, as there

is no real agreement on a standard soil, a reproducible soiling process or the amount of soil a shampoo should ideally remove as seen from the results, there is a significant difference in the amount of sebum removed by the different shampoos. The cleaning action of formulation F1 to F6 and Marketed product was found to be 27.51, 32.15, 30.12 28.15, 33.12, 31.14 and 30.33

Stability Stability and acceptability of organoleptic properties (odor and color) of formulations during the storage period indicated that they are chemically and physically stable. Stability study of formulation F1 to F6 and marketed product was found to be stable.

Test	F1	F2	F3	F4	F5	F6
Stability studies	Stable	Stable	Stable	Stable	Stable	Stable

Evaluation parameters	Formulation B	Marketed powder shampoo	
Organoleptic evaluation	Colour	Greenish brown	Brownish
	Odour	Slight	Slight
	Taste	Characteristic	Slight bitter
	Texture	Fine and smooth	Fine and smooth
General powder characteristics	Particle size	20-25 um	20-25 um
	Angle of repose	22.48	24.45
	Bulk density	0.32 g/m ³	0.92g/m ³
	Tapped density	0.35 g/m ³	0.84g/m ³
Physicochemical evaluation	Extractive value		
	-Alcohol soluble	17.19%w/w	16.23% w/w
	-Water soluble	12.58%w/w	14.45% w/w
	Moisture content	3.00%	4.3%
	pH	4.9 ± .02	4.3±0.05
Foaming capacity	V.Good foaming	V.Good foaming	
Foreign matter	0.284%	0.12%	
washability	Easily washable	Easily washable	
Nature of hair after wash	Soft manageable	Soft manageable	
Wetting time	1min 20 sec	56sec	
Dirt dispersion	Moderate	Moderate	
Solubility	Soluble with water	Soluble with water	
Cleaning action	32.15 ±0.09	30.33±0.03	
Stability study	Stable	Stable	

Summary and conclusion

Natural remedies are in high demand these days, and this is growing in Western countries. Herbs that are the least expensive phytoconstituents are

on the move to fulfil their role in polyherbal formulations in order to play a synergistic role. Shampoo with a polyherbal formulation is helpful in decreasing dan-druff while causing

less irritation, providing better conditioning and preventing hair fall. The popularity and demand for herbal cosmetics is growing, since it is often assumed that these products are safe and free of adverse effects. According to the findings of the study, all six shampoo powders are satisfactory and have all of the required properties, even though formulation B was found to be more acceptable in terms of wetting time, foam stability, dirt dispersion, and cleaning action. The produced shampoo powders, on the other hand, are in dry powder form and have no change in stability after long storage.

The medicinal plants utilised in the production of herbal shampoo were discovered to be a rich source of helpful chemical components. Orange peel, Amla, Hibiscus, Reetha, Neem, Shikakai, and Fenugreek have all been reported to help with hair growth, antidandruff, cleansing, and conditioning. All of the required quality control parameters were thoroughly examined and yielded positive and acceptable results. The findings of this study show that including these beneficial herbal elements into shampoo results in a more stable and effective product with a decent look and patient compliance.

The shampoo has a good pH, which aids in improving and boosting hair quality, reducing eye irritation, and stabilising the ecological balance of the scalp. The formulation's foaming capacity when in contact with water, which aids in the reduction of surface tension and proper application of the shampoo to the scalp. The formulation has a high wetting and foaming index. All of the evaluation parameters, such as organoleptic evaluation, general powder characteristics, physicochemical evaluation, cleaning action, foaming, dirt dispersion, wetting agent, and nature of hair after wash, were performed in accordance with standard guidelines and were found to be within the standard range.

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