Abstract

Dandruff is a common disorder affecting the scalp condition caused by yeast Pityrosporum. Dandruff cannot be completely eliminated but can only be managed and effectively controlled. Shampoo is a hair care product used for the removal of oils, dirt, skin particles, dandruff, environmental pollutants and other contaminant particles that gradually build up in hair. Herbal anti-dandruff shampoos were formulated using herbal based ingredients like Lemon Grass Oil, Neem oil, Henna, Aloe Vera gel and other ingredients for preparing base shampoo. The formulated shampoos were subjected to evaluation parameters like visual inspection, pH, viscosity, Percentage of solids contents, Dirt dispersion, Surface tension, Foaming ability and foam stability. The main objective of this study was to eliminate harmful synthetic ingredient from anti-dandruff shampoo formulation and substitute them with a safe natural ingredients.

Keywords: Powder shampoo, Anti-dandruff, Polyherbal, Pityrosporum.

1. Introduction

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 other human [1]. The problems of hairs includes 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 [2]. In this direction, we are presenting here polyherbal antidandruff shampoo which is used as a multipurpose for hair treatment with fewer side effects in a daily life. Dandruff is clinical condition caused by Malassezia (Pityrosporum) species is of great cosmetic concern all over the world. Pityrosporum ovale is strongly suspected to play a role in the manifestation of the seborrheic dermatitis [3]. Herbs are widely used as remedial agents because such drugs are easily available at low cost and comparatively safe and the people have good faith in such remedies. In India, Ayurvedic system evolved over 5,000 years ago and is still in practice. The Rig Veda and Atharvanaveda have included more than 700 medicinal prescriptions [4]. There are also wide range of herbal ingredients like pepper extract, basil extract, neem extract, rosemary oil, basil oil, clove oil, coleus oil, tea tree oil which have been documented to have good anti Pityrosporum oranti dandruff activity.
Herbal formulations have growing demand in the world market [5].

At present, various treatments of dandruff include therapeutic use of zinc pyrithione, salicylic acid, imidazole derivatives, glycolic acid, steroids and sulphur etc. However, these agents show certain limitations, either due to poor clinical efficacy. To overcome these entire problems, the polyherbal powder shampoo is formulated using natural ingredients with *Acacia concinna* (Shikakai), *Lawsonia inermis* (Henna), *Aloe vera* (Aloe), *Ocimum sanctum* (Tulsi), *Azadiracta indica* (Neem) and Fenugreek (Methi) etc. with fewer side effects.

1. Materials and methods [6-8]

1.1. Sample collection

The different parts of the plants selected for the study having hair care property which is already proved. All the ingredients were purchased from local market of Yamuna-Nagar. The lists of herbs used are depicted in the Table 1.

1.2. Preparation of the Herbal Shampoo Powder

1.2.1. Drying of Ingredients

All the herbal ingredients are in dry form and grinded to make fine powder by using size reduction mill.

1.2.2. Weighing

All the required herbal powders for shampoo preparation were weighed individually by using digital balance the used quantity is listed in Table 2.

1.2.3. Size reduction

The crude ingredients were collected and these ingredients were size reduced using hand driven mixer individually.

1.2.4. Mixing

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

1.2.5. Sieving

Then this fine powder was passed through sieve no.:120 , to get the sufficient quantity of fine powder.

1.2.6. Collection and storage

The powder mixture was collected and store in suitable plastic container and used for doing evaluation parameters.

1.3. Evaluation of Antidandruff Polyherbal Shampoo containing different herbs [9-10]

1.3.1. Organoleptic evaluation/visual appearance

Organoleptic evaluation for parameters like colour, odour, taste and texture was carried out. Colour and texture was evaluated by vision and touch sensation respectively. For taste and odour evaluation a team of five taste and odour sensitive persons were selected.

1.3.2. General 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.

1.3.3. Particle size

Particle size is a parameter, which affect various properties like spreadability, grittiness etc., particle size was determined by sieving method by using I.P. Standard sieves by mechanical shaking for 10 min.
Table 1: Herbs used in the preparation herbal shampoo powder

<table>
<thead>
<tr>
<th>SN</th>
<th>Ingredient</th>
<th>Biological name</th>
<th>Use of ingredient</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lemon</td>
<td>Dried fruits of <em>Citrus limon</em> (<em>Rutaceae</em>)</td>
<td>Antidandruff, natural cleanser, pH modifier</td>
</tr>
<tr>
<td>2</td>
<td>Methi powder</td>
<td>Dried seeds of <em>Trigonella foenum-graecum</em> (<em>Leguminosae</em>)</td>
<td>Conditioning and nourishment of hair.</td>
</tr>
<tr>
<td>3</td>
<td>Hibiscus Leaves</td>
<td>Dried leaves of <em>Hibiscus roseus</em> (<em>Malvaceae</em>)</td>
<td>Prevents hair loss and hair growth promoter.</td>
</tr>
<tr>
<td>4</td>
<td>Neem Leaves</td>
<td>Dried leaves of <em>Azadirachta indica</em> (<em>Meliaceae</em>)</td>
<td>Fight scalp infection, prevent the dryness and flaking of hairs, lice, dandruff and itching.</td>
</tr>
<tr>
<td>5</td>
<td>Shikakai fruit</td>
<td>Dried pods of <em>Acacia concinna</em> (<em>Mimosaceae</em>)</td>
<td>Foam base and anti-dandruff, to improve hair and skin and it clears dandruff and the dirt accrued on the scalp.</td>
</tr>
<tr>
<td>6</td>
<td>Aloe vera leaf</td>
<td>Dried leaves of <em>Aloe barbadensis</em> miller (<em>Asphodelaceae</em>)</td>
<td>Condition and moisturizing effect.</td>
</tr>
<tr>
<td>7</td>
<td>Henna Leaves</td>
<td>Dried leaves of <em>Lawsonia inermis</em> (<em>Lythraceae</em>)</td>
<td>Growth of hair, Conditioner.</td>
</tr>
<tr>
<td>8</td>
<td>Brahmi root</td>
<td>Dried roots of <em>Centella asiatica</em> (<em>Apiaceae</em>)</td>
<td>Support to growth of Hairs.</td>
</tr>
<tr>
<td>9</td>
<td>Reetha fruit</td>
<td>Dried fruits of <em>Sapindus mukorossi</em> (<em>Sapindaceae</em>)</td>
<td>Reetha is a foaming agent.</td>
</tr>
<tr>
<td>10</td>
<td>Amla fruit</td>
<td>Dried ripe fruits of <em>Emblica officinalis</em> (<em>Euphorbiaceae</em>)</td>
<td>Darkening of hairs and Hair growth promoter.</td>
</tr>
<tr>
<td>11</td>
<td>Nagarmotha</td>
<td>Dried ripe fruits of <em>Cyperus rotundus</em> (<em>Cyperaceae</em>)</td>
<td>Scalp disorder</td>
</tr>
<tr>
<td>12</td>
<td>Tulsi</td>
<td>Dried leaves of <em>Ocimum sanctum</em> (<em>Lamiaceae</em>)</td>
<td>Antibacterial</td>
</tr>
</tbody>
</table>
Table 2. Formulation and composition

<table>
<thead>
<tr>
<th>SN</th>
<th>Ingredient</th>
<th>Formulated</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lemon</td>
<td>1.5gm</td>
</tr>
<tr>
<td>2</td>
<td>Methi powder</td>
<td>2gm</td>
</tr>
<tr>
<td>3</td>
<td>Hibiscus Leaves</td>
<td>2gm</td>
</tr>
<tr>
<td>4</td>
<td>Neem Leaves</td>
<td>2gm</td>
</tr>
<tr>
<td>5</td>
<td>Shikakai fruit</td>
<td>2gm</td>
</tr>
<tr>
<td>6</td>
<td>Aloe vera leaf</td>
<td>1.5 gm</td>
</tr>
<tr>
<td>7</td>
<td>Henna Leaves</td>
<td>0.5 gm</td>
</tr>
<tr>
<td>8</td>
<td>Brahmi root</td>
<td>0.5 gm</td>
</tr>
<tr>
<td>9</td>
<td>Reetha fruit</td>
<td>0.5 gm</td>
</tr>
<tr>
<td>10</td>
<td>Amla fruit</td>
<td>1 gm</td>
</tr>
<tr>
<td>11</td>
<td>Nagarmotha</td>
<td>0.5 gm</td>
</tr>
<tr>
<td>12</td>
<td>Tulsi</td>
<td>1 gm</td>
</tr>
</tbody>
</table>

1.3.4. Angle of repose
It is defined as the maximum angle possible in between the surface of pile of powder to the horizontal flow.

1.3.5. Funnel method
Required quality of dried powder is taken in a funnel placed at a height of 6 cm from a horizontal base. The powder was allowed to flow to form a heap over the paper on the horizontal plane. The height and radius of the powder was noted and recorded. The angle of repose (θ) can be calculated by using the formula.

\[ \theta = \tan^{-1}\left(\frac{h}{r}\right) \]

Where,
\[ \theta \] – Angle of repose, \( h \) – Height of the heap, \( r \) – Radius of the base

1.3.6. Open-ended cylinder method
Required amount of dried powder is placed in a cylindrical tube open at both ends is placed on a horizontal surface. Then the funnel should be raised to form a heap. The height and radius of the heap is noted and recorded. For the above two methods, the angle of repose (θ) can be calculated by using the formula.

\[ \theta = \tan^{-1}\left(\frac{h}{r}\right) \]

1.3.7. 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. The Bulk Density is calculated by using the below given formula.

\[ \text{Bulk Density} = \frac{\text{Mass of the herbal powder shampoo}}{\text{Volume of the herbal powder shampoo}} \]

1.3.8. 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 centimeter (g/cm³).

1.4. Physicochemical evaluation

1.4.1. 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.

1.4.2. Washability
Formulations were applied on the skin and then ease and extent of washing with water were checked manually.

1.4.3. Solubility
Solubility is defined as the ability of the substance to solubile in a solvent. One gram of the powder is weighed accurately and transferred into a beaker containing 100 ml of water. This was shaken well and warmed to increase the solubility. Then cooled and filtered it, the residue obtained is weighed and noted.

1.4.4. Loss on drying
Loss on drying is the loss of mass expressed in percent m/m. Two gram of the powder is weighed accurately and transferred into a dry Petri dish. The Petri dish is placed in a dessicator for 2 days over calcium chloride crystals. Then the powder was taken and weighed accurately to find out the weight loss during drying.

1.4.5. Skin /eye irritation test
The eye and skin irritation tests revealed that the herbal shampoo powder shows no harmful effect on skin and eye. This is due to the absence of synthetic surfactants. Most of the synthetic surfactants produce inflammation of the eyelid and corneal
irritation. But in this formulation of herbal shampoo powder, the uses of all ingredients are obtained naturally. So it does not produce any harmful effect on skin and eye.

2.4.6. Extractive values [11-12]

2.4.6.1. Determination of alcohol soluble extractive
5 g of each air dried herbal shampoo powder was weighed and macerated with 100 ml of Alcohol of the specified strength in a closed flask for twenty-four hours, shaked frequently during six hours and allowed to stand for eighteen hours. Filtered, by taking precautions against loss of solvent, 25 ml of the filtrate was evaporated to dryness in a tare flat bottomed shallow dish, and dry at 105°C, to constant weight and weighed. The percentage of alcohol-soluble extractive with reference to the air-dried drug was calculated.

2.4.6.2 Determination of water soluble extractive
Proceeded as directed for the determination of alcohol-soluble extractive, using chloroform water instead of ethanol. The percentage of water-soluble extractive was calculated for each sample.

2.4.7. Ash value
2.4.7.1. Total ash content
Ash value is calculated to determine the inorganic contents which is characteristic for a herb. About 2 gm of powder drug was taken in silicon dish previously ignited and weighed. Temperature was increased by gradually increasing the heat not exceeding to red colour. After complete burning, ash is cooled and weighed.

2.4.7.2. Acid insoluble ash
Acid insoluble ash was calculated by boiling above obtained ash with 25 ml dil. Hcl for 5 min, insoluble matter was collected in gooch crucible, washed with hot water, ignited and weighed.

2.4.8. 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.

2.4.9. Moisture content determination
10 g of each herbal shampoo powder was weighed in a tare evaporating dish and kept in hot air oven at 105°C. Repeated the drying until the constant weight loss was observed after the interval of 30 minutes. The moisture content was calculated for each sample.

2.4.10. Nature of hair after washes
Nature of hair after wash can be done by collecting the responses of volunteers.

2.4.11. Foaming Index/Ability
One gram of the powder was weighed accurately and transferred into 250 ml conical flask containing 100 ml of boiling water. Then it is warmed gently for 30 minutes, cooled and filtered and make up the volume to 100 ml in standard volumetric flask. This extract is taken in 10 test tubes in a series of successive portion of 1, 2, 3…,10 ml and remaining volume is made up with water to 10 ml. Then the test tubes were shaken in longwise motion for 15 seconds at speed of 2 frequencies / second. Then the tubes are allowed to stand for 15 minutes. The height of the foam was measured.

\[
\text{Foaming index =} \frac{1000}{a}
\]

1.5. Stability studies
Stability studies were performed in accordance with ICH guidelines for accelerated testing with required modifications. The sample taken formulation was taken and kept at room temperature (30 ± 20°C) as well as refrigerator (4±20°C) for duration of one month. The samples were tested for their physical appearance, pH, viscosity, % cleaning action and foam stability.

2. Results and discussions

2.1. Organoleptic evaluation/visual appearance:
Organoleptic evaluation parameters like colour, odour and texture were carried out. The results were depicted in Table 3.

Table 3: Organoleptic evaluation
Table 3: Organoleptic evaluation

<table>
<thead>
<tr>
<th>Organoleptic Characteristics</th>
<th>Formulated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colour</td>
<td>Green</td>
</tr>
<tr>
<td>Odour</td>
<td>Characteristic</td>
</tr>
<tr>
<td>Nature of powder</td>
<td>Fine Powder</td>
</tr>
<tr>
<td>Texture</td>
<td>Smooth</td>
</tr>
</tbody>
</table>

2.2. General powder characteristics:

All the three shampoo powders were taken at three different levels for the evaluation. The results are listed in Table 4.

Table 4. General Powder Characteristics

<table>
<thead>
<tr>
<th>SN</th>
<th>Character</th>
<th>Formulated</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Particle Size</td>
<td>20-25 um</td>
</tr>
<tr>
<td>2</td>
<td>Bulk Density</td>
<td>0.86 gm/ml</td>
</tr>
<tr>
<td>3</td>
<td>Tapped Density</td>
<td>1.1gm/ml</td>
</tr>
<tr>
<td>4</td>
<td>Angle of Repose</td>
<td>28°7</td>
</tr>
</tbody>
</table>

2.3. Physicochemical evaluation

2.3.1. Solubility test

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 results are listed in Table 5.

Table 5. Physicochemical evaluation

<table>
<thead>
<tr>
<th>SN</th>
<th>Test</th>
<th>Formulated</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>pH</td>
<td>6.52</td>
</tr>
<tr>
<td>2</td>
<td>Washbility</td>
<td>Easily washable</td>
</tr>
<tr>
<td>3</td>
<td>Solubility</td>
<td>Easily soluble with water</td>
</tr>
</tbody>
</table>

2.3.2. Angle of response

Good flow property is essential in formulation of any powder. The angle of response of herbal shampoo powder was 28.7. This confirms that the powder has good flow property. The results are listed in Table 4.

2.3.3. Bulk density

The bulk density of the herbal shampoo powder was 0.86. This measurement indicates that the loose powder packing may be to the presence of large inter-particle spaces. The results are listed in Table 4.

2.3.4. Foaming index

This 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 sapoindoside A and B. the results are listed in Table 5.

2.3.5. Eye irritation and skin irritation test

The eye and skin irritation tests revealed that the herbal shampoo powder shows no harmful effect on skin and eye. This is due to the absence of synthetic surfactants. Most of the synthetic surfactants produce inflammation of the eyelid and corneal irritation. But in this formulation of herbal shampoo powder, the uses of all
ingredients are obtained naturally. So it does not produce any harmful effects on skin and eye.

Conclusion

The aim of this study was to formulate a completely herbal shampoo which has no side effects. We formulated a herbal shampoo by using dried plant which are commonly used traditionally and lauded for their hair cleansing actions. All the ingredients used to formulate shampoo are safer than silicones and polyquaterniums synthetic conditioning agents. Instead of using cationic conditioners we have used Sheekakai, Amla, and other plant to provide the conditioning effects. Several tests were performed to evaluate and compare the physicochemical properties of both prepared From this investigation it can be concluded that the formulation of anti-dandruff herbal shampoo powder contain all good characters of an ideal shampoo and it was found to be harmless, more effective and economic.

References


