FORMULATION AND EVALUATION OF POLYHERBAL ANTI-DANDRUFF SHAMPOO UTILIZING BANYAN AERIAL ROOT EXTRACT

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ABSTRACT

Dandruff a common scalp disorder characterized by flaking and itching, is often managed with synthetic chemical-based shampoos that can sometimes lead to adverse effects. This research investigates the potential of a polyherbal formulation as a natural and potentially gentler alternative. The present study focuses on the preparation of a novel anti-dandruff shampoo incorporating extracts of banyan aerial roots (ficus benghalensis), bramhi (bacopa monnieri), neem (azadirachta indica), indigo leaf (indigofera tinctoria), and amla (emblica officinalis). Aqueous extracts of these plant materials were prepared and incorporated into a shampoo base containing sodium lauryl sulfate (SLS) as the primary surfactant, along with co-surfactant, along with co-surfactants, thickeners, and preservatives. The formulated polyherbal shampoo was then subjected to various physicochemical evaluations (appearance, pH, viscosity, foaming ability, wetting time, and dirt dispersion), stability studies and preliminary safety assessment (patch test).

KEYWORDS - Polyherbal Formulation, Ficus Benghalensis, Bacopa Monnieri, Azadirachta Indica, Physicochemical Evaluation, Stability Studies.

INTRODUCTION

Shampoos have become a very big part of our hair care routine today. However, in the past,

using shampoo was not so popular. At that time, most people used soap to wash themselves from head to toe. Gradually, people realized the importance of shampoo and started giving it a place in their bathrooms. Shampoo is a hair care product that is generally available in the form of a thick liquid. Shampoo is used to clean hair. Very rarely, shampoo is also available in the form of a soap bar. Shampoo is applied to wet hair and the hair is massaged, after which it is rinsed off with water. Some people even use hair conditioner after shampooing their hair. The word 'shampoo' is actually a corrupted form of the Indian words 'champi' or 'champoo'. The word shampoo came to India during the British rule. The origin of the word shampoo is believed to be around the year 1762. The root of the words champi or chaampo also goes back to the Sanskrit word 'chapayati'. The meaning of chapayati is to press, knead, or caress. In the Indian subcontinent, since ancient times, various types of herbs and their extracts have been used like shampoo. The very first shampoo made in India was prepared by boiling the fruit of the Indian tree 'ritha' (Soapberries or Soapnuts), amla (Indian Gooseberry), and other herbs together.

In Vedic texts and Ayurveda, ritha has been addressed as 'kshuna'. The pulp of ritha is a natural surfactant that helps in cleaning hair. The lather that forms in the head when ritha pulp is rubbed into the hair was called 'phenaka' in Sanskrit. Its use made the hair soft, shiny, and also easily detangled knotted hair. Other products that were prominently used for washing hair include shikakai (Acacia Concinna), hibiscus flowers, ritha (Sapindus Mukorossi), and arappu (Albizzia Amara). The extent to which ritha was used for washing hair can also be understood from the fact that Shri Guru Nanak Dev Ji, the founder and first Guru of Sikhism, also mentioned washing hair with the ritha tree and Its fruits in his 16th-century text. The main reason for using shampoo is to remove unwanted dirt from the hair. This dirt includes natural oil (sebum) released from the hair roots, dust, dirt, dead skin, and heavy metals present in the air. These are all the elements that together form a sticky layer around the hair roots, making hair care very difficult for us. If this condition persists for a long time, not only will hair fall out or break more, but it can also lead to baldness/male pattern baldness.

Dandruff is a chronic, non-inflammatory condition of the scalp that is caused by overproduction of oil on the scalp. It is caused by a condition called seborrheic dermatitis or by a fungus called malassezia. The Indian traditional system of medicine, ayurveda, describes numerous herbs with potential benefits for hair and scalp health. The present study aims to

formulate and evaluate a polyherbal anti-dandruff shampoo incorporating a synergistic blend of seven such traditionally used plant materials

PLANT PROFILE

Table no. 1: plant profile.

Name of Drug	Botanical Classification	Chemical Constituents	Uses
 Ficus benghalensis	Kingdom: Plantae Division: Tracheophyta Class: Magnoliopsida Family: Moraginaceae Common name: Banyan Tree	Tannins, flavonoids, phenolics	Hair strengthenin, anti-inflammator, scalp health
 Bacopa monnieri	Kingdom: Plantae Division: Tracheophyta Class: Magnoliopsida Family: Plantaginaceae Common name: water hyssop, bramhi	Saponin, flavonoids, alkaloids	Anti-inflammator, antioxidant
 Azadirachta indica	Kingdom: Plantae Division: Magnoliophyta Class: Magnoliopsida Family: Meliaceae Common name: Neem, margosa	Triterpenoids alkaloids, flavonoids, saponins	Antifungal, antibacterial, use against malassezia species
 Embilica officinalis	Kingdom:Plantae Division:Tracheophyta Class:Magnolopsida Family: Euphorbiaceae Common name: Indian grossberry, amla	Tannins, polyphenols, alkaloids	Antioxidant, antimicrobial, Anti-inflammatory
 Sapindus mukorossi	Kingdom:Plantae Class:Magnoliopsida Family: Sapindaceae Common Name: Sopnut, Reetha	Saponins, triterpenoids, flavonoids, fatty acids	Cleansing and soothing, antibacterial
 Senegalia rugata	Kingdom: Plantae Family: Fabaceae	Saponins, tannins, flavonoids, alkaloids, vitamin, minerals	Cleansing, strengthenin, detangling, prevents graying, shine and texture

RESEARCH METHODOLOGY

1. Collection of Plant Material

Washing: collected roots are washed to remove dirt.

Location: Banyan aerial roots are collected from local areas.

Drying: the roots then shade dried to reduce moisture present in the roots.

Grinding: The dried roots are then grind and pass through fine sieve.

2. Preparation Of Herbal Extracts

1. Preparation of banyan aerial root extract: The roots powder mixed with the 70% ethanol and subjected to maceration for 72 hours at room temperature with intermittent stirring. The extract then filtered, and potentially concentrated to enhance the API concentration within the final 25 ml volume.

2. Preparation of reetha extract: Due to saponin content in reetha , a warm extraction method is most effective. Reetha powder is mixed with water and heated gently in a water bath (50-60 C) for 1 hour to facilitate saponin release. The resulting solution is filtered to obtain the reetha extract,

3. Preparation of other herb extract: the powdered form of neem, shikakai, brahmi, and amla are subjected to aqueous extraction. The mixtures are macerated at room temperature for 48 hours under gentle agitation to maximize the extraction of water soluble bioactive compounds. Then the extracts filtered through muslin cloth.

3. Formulation of Polyherbal Anti-Dandruff Shampoo (F1)

a. Carbopol gel preparation

0.4 grams of carbopol is slowly and uniformly dispersed in approximately 30 ml of water under continous stirring using a magnetic stirrer at a moderate speed to prevent clogs. The dispersion is allowed to hydrate until the carbopol is fully swollen and a homogenous dispersion is formed. 10 % w/v aqueous solution of NaOH added drop wise with constant stirring, while monitoring the pH. The neutralization process continues until the pH reaches optimal range of 5.5-7.0, resulting in the formation of a clear, viscous carbopol gel.

b. Preparation of methyl parabean solution

0.02 grams of Methyl Parabean weighed and dissolved in 10 ml of warm water under gentle stirring until a clear and colorless solution is obtained. The solution is allowed to cooling at room temperature.

c. Mixing phase

In a clean beaker (250 ml), the 25 ml of banyan aerial root extract and the 25 ml of the concentrated herbal extract blend thoroughly mixed using a glass stirring rod. The prepared carbopol gel then slowly added into the herbal extract mixture under gentle continous stirring to ensure uniform distribution and thickening of base. Then the 10 ml of a 15% w/v aqueous solution of sodium lauryl sulfate is added with careful stirring to avoid excessive foam formation. The 10 ml of methylparabean solution is added and mixed thoroughly.

d. Final adjustments

The pH of the mixture is measured using a pH paper. The 10% w/v aqueous solution of Citric Acid is added dropwise with constant stirring until the pH reaches the range of 5.5-7.0. 0.3 ml of the lavender oil added and gently stirred to ensure uniform dispersion. Finally water is added to make total of the shampoo to exactly 100 ml. the final mixture stir gently for 5-10 minutes to ensure homogeneity.

Table no.2: Composition Of Polyherbal Shampoo.

Sr.No	Drug	F1(ml)	F2(ml)	F3(ml)	Properties
1.	Extract of Ficus benghalensis	25 ml	25ml	25ml	Anti inflammatory, strengthening.
2.	Extract of Azadirachta indica	5ml	3ml	5ml	Antimicrobial, antifungal
3.	Extract of Acacia concinna	8ml	8ml	5ml	Cleanser
4.	Extract of Bacopa monnieri	3.5ml	4ml	5ml	Hair growth, strenghtening
5.	Extract of Sapindus mukorossi	7 ml	8ml	5ml	Foaming agent
6.	Extract of Emblica officinalis	1.5 ml	2ml	5ml	Antioxidant
7.	SLS	10 ml	10ml	10ml	Surfactant
8.	Carbopol	30 ml	30ml	30ml	Thickner
9.	Methyl parabean	10 ml	10ml	10ml	Preservative
10.	Citric acid	q.s	q.s	q.s	pH stabilizer
11.	Water	q.s	q.s	q.s	Solvent
12.	Total	100ml	100ml	100ml	

EVALUATION OF POLYHERBAL SHAMPOO

Preformulation Studies

1. Preliminary phytochemical tests

- **Test for flavonoids**

To the extract solution added a few ml of sodium hydroxide was added, yellow colour appearance is disappears on addition of dilute acid indicates the presence of flavonoids.

- **Test for saponins**

 Place 2 ml of extract in water test tube , shake well, stable froth is formed.

- **Test for Tannins**

1. Take 2-3 ml of the plant extract in a test tube
2. Add a few drops (about 1 ml) of glacial acetic acid.
3. Mix gently and stand for some time.
4. Formation of the red colour.

- **Test for the Terpenoid**

1. Take 2 mL of plant extract in a test tube.
2. Add 2 mL of chloroform and mix well.
3. Carefully add 3 mL of concentrated sulfuric acid down the side of the test tube to form a layer.
4. A reddish-brown coloration at the interface of the two layers indicates the presence of terpenoids.

- **Test for amino acid**

Ninhydrin test

to test solution, add ninhydrin solution, boil violet colour indicates presence of amino acid.

Millons test

To test solution, add about 2 ml of millons reagent, white precipitates indicates presence of amino acid.

2. pH: First, the pH meter was calibrated using a pH 7 buffer solution. Then, it was further adjusted using buffer solutions with known pH values ranging from 4 to 9.2. About 30 to 40 ml of the herbal shampoo was poured into a beaker. The electrode of the pH meter was then immersed in the sample, and the pH value was read from the meter's digital display.

3. Determination of extractive value

The 2 gm powder of banyan aerial roots weighed and macerated with water, ethanol with occasionally stirring. The extract is filtered to remove any solid particles. The filtrate is then evaporated to dryness and the residue is then dried.

Extractive value = weight of dried extract/ weight of plant material $\times$ 100

5. Determination of ash value

Weigh a clean, dry porcelain crucible and records its weight. Then add 2 gm of powder into crucible and record the total weight. Place in oven at 600 c for 2 hours, and then allow to cool. Weigh the crucible with ash and record its weight.

Post Formulation Tests

• **Appearance:** the formulation prepared was evaluated for the clarity, color, and odor.

• **Stability Test at Room Temperature:** To check stability, the product was stored at different temperature ranges and observed for any changes.

• **Wetting time:** Wetting time was calculated by observing the time requird by canvas paper to sink completely.

• **pH:** The ph of 10% w/v shampoo solution in distilled water was measured by using Ph meter at room temperature.

• **Homogeneity Test:** A small amount of the sample was placed on a glass slide to check its uniformity. In a properly mixed (homogeneous) preparation, there should be no undispersed particles visible.

• **Irritation Test:** About 1–2 ml of the formulation was applied to the skin on the left hand and monitored for 2 hours to check for any redness, irritation, or inflammation.

• **Foaming index determination**
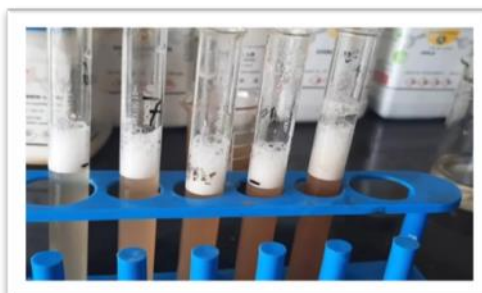
This test is performed to check the foaming ability of the formulated shampoo. Five test tubes are taken and add then add the sample to test tube in increasing order (1ml, 2ml, 3ml,

4ml,5ml) , the volume of each test tube is make up to 10 ml. then the tubes are shaken and then the foam is calculated.

- **Dirt dispersion test**

This test is performed to check the dirt cleansing capacity of prepared shampoo. The test tube is taken containing prepared shampoo and then water is added and then ink is added and shaken together. If foam formed is light in colour then shampoo has good dirt cleansing action.
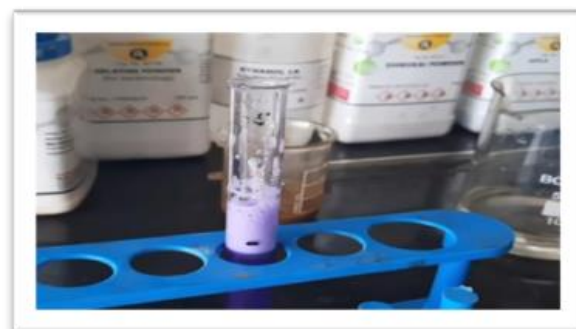
RESULTS AND DISCUSSION

➢ **Preformulation studies**

1. Organoleptic properties(API)

Table no.3 : organoleptic properties.

Sr.no	Parameter	Observation
1.	Color	Organish-brown
2.	Odor	Aromatic
3.	Taste	Astringent

2. Physicochemical properties(API)

Table no. 4: physicochemical properties.

Sr.no	Parameter	Test Method	Observation	Standard
1.	Solubility	Mixing with water	Partially soluble in water.	Partially soluble in water.
2.	Ph of extracts	pH meter	Slightly acidic	Slightly acidic
3.	Phytochemical tests	Alkaloids	-	-
		Terpenoids	+	+
		Tannin	+	+
		Saponin	+	+
		Carbohydrate	-	-
		Phenol	+	+
4.	Ash value	Total ash	3.20 (w/w)	3% to 4%
		Acid insoluble ash	31.44 (w/w)	Below 5%

		Water soluble ash	3.56 (w/w)	2% to 5%
5.	Extractive value	Water extraction	24.37%	10.5-25%

➢ **Post formulation studies**

3. Organoleptic evaluation

Table no.5: organoleptic evaluation.

Sr.no	Parameter	Observation
1.	Color	Brownish
2.	Odor	Pleasant
3.	Appearance	Turbid

4. Physicochemical evaluation

 Table no.6: physicochemical evaluation.

Sr.no.	Parameter	Test	Observation value	Standard value
1.	pH	pH Meter	5.98	5.0-7.0
2.	Viscosity	Ostwald viscometer	3000 cP	2500-9000 cP
3.	Foaming index	Cylinder shake method	300	500
4.	Cleansing action	Apply on hair	Good	Good
5.	Dirt dispersion	Ink test	No dirt	No dirt
6.	Irritation test	Patch test	No irritation	No irritation

CONCLUSION

This study successfully formulated and evaluated a polyherbal anti-dandruff shampoo utilizing banyan aerial root extract as main API blended with other herbs such as need, brahmi, shikakai, reetha and amla. This polyherbal formulation gives natural, effective, and safe alternative for managing dandruff. Further long-term stability studies and clinical efficacy trials would be beneficial to fully establish it's potential.

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