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Research Paper

Development And Assessment of Natural Herbal Shampoo: A Botanically Based Approach

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ABSTRACT

This study focuses on the formulation and evaluation of a polyherbal shampoo using plant-derived ingredients like Hibiscus, Neem, Henna, Amla, Shikakai, Ritha, and Aloe-vera, all obtained in powder form from local markets. The preparation involved creating a decoction and mixing the powders, after which the shampoo was assessed for organoleptic and physico-chemical properties. The resultant herbal shampoo not only cleanses but also conditions hair, promoting health and addressing issues like dandruff and lice while being safer and less allergenic compared to synthetic options. The findings underscore the beneficial properties of herbal shampoos, highlighting their potential as effective cosmetic products.

INTRODUCTION

Cosmetics

Shampoo is a viscous cosmetic product designed primarily for cleaning hair and scalp, utilizing synthetic detergents as surfactants to effectively remove oil, dirt, and residues without harming the user. It comes in various forms such as liquid, solid, or powder and can also provide additional benefits like conditioning, anti-static properties, and medicinal effects. Ensuring that the formulation is medically safe for long-term use is paramount in its development and marketing.

Anatomy Of Hair

Hair is a keratin fiber that grows from the epidermis, originating from a hair follicle, which is an epidermal penetration of the dermis. The hair is composed of two main parts: the hair shaft, visible above the skin's surface, and the hair root, anchored below the surface in the follicle, ending at the hair bulb, a region of active cell division. The hair root surrounds the hair papilla, containing blood capillaries and nerve endings, and both the hair shaft and root are made up of three layers of cells, working together to form the complex structure of hair.

1. Medulla.

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2. Cortex.

3. Cuticle.

The hair structure consists of three layers: the central core called the medulla, which is surrounded by the cortex comprised of compressed, keratinized cells, and finally enveloped by the cuticle, the outermost layer made up of very hard, keratinized cells that protects the inner layers of the hair.

The hair growth cycle consists of three stages: the growth stage (Anagen), during which cells in the hair matrix divide and new cells are added at the base of the hair root; the regression stage (Catagen), where hair cell division ceases, causing the follicle to shrink and halting growth; and the resting stage (Telogen), when old hair falls out and a new growth cycle begins. Additionally, there are four main types of hair: straight hair, which is shiny but less voluminous; wavy hair, which is thicker and has a texture between straight and curly; curly hair, characterized by loose ringlets or tight spirals; and kinky hair, or coily hair, which features curls that resemble "S" or "Z" shapes.

A cleansing agent containing synthetic detergents and various additives

Leaves hair soft, non-sticky, and manageable after use

General method of preparation

Detergents, preservatives, and other ingredients are dissolved in a suitable solvent (e.g. water, alcohol)

Colouring agent is dissolved in a suitable solvent

Colouring agent solution is added to detergent solution and mixed well

Preparation is flavoured

Ideal properties of a shampoo

1. Ease of application: Viscous enough to stay in hair before application, yet spreads easily and disperses quickly over hair and scalp

2. Lather: Develops a dense and luxurious lather

3. Removal of debris: Effectively removes dust, soil, sebum, loose corneal cells, and residual substances from previously used cosmetics

4. Rinsing: Rinses out easily without leaving residual tackiness or stickiness

5. Easy wet combing: Hair comb through easily without tangling

6. Manageability: Hair left in a manageable condition when combed dry

7. Luster: Hair left in a lustrous condition

8. Body: Hair has "body" when dry, not limp or over-conditioned

9. Fragrance: Develops a clean refreshing scent during shampooing and leaves a clean residual scent on hair

10. Low level of irritation: Irritation level kept as low as possible

11. Well preserved: Product properly preserved against microbial and fungal contamination
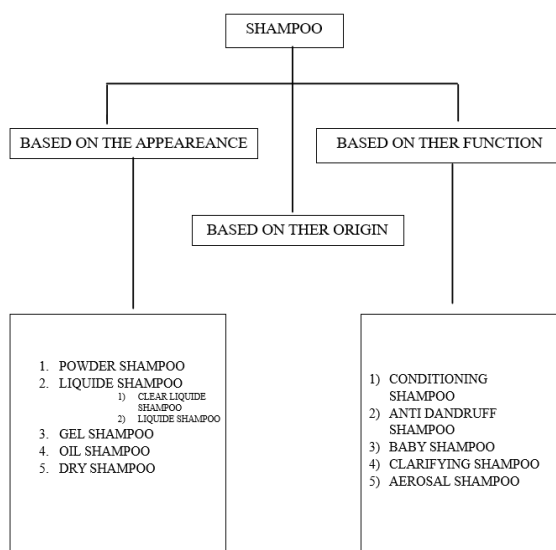
12. Good stability: Product has good stability for at least 2-3 years at room temperature and in various storage conditions

13. Economical: Formulation should be as simple as possible using only necessary raw materials

Formulation Of Shampoo

A typical shampoo formulation includes several essential components that work together to achieve desired properties. Surfactants serve as the primary cleansing agents, while *foam boosters and stabilizers enhance lather quality. Conditioning agents improve hair texture and manageability. Special additives may provide additional benefits, such as enhanced moisture or scalp health. Preservatives are included to prevent microbial growth, and sequestering agents help to bind metal ions that can affect product stability. Viscosity modifiers control thickness, while opacifying or clarifying agents improve the appearance of the shampoo. Additionally, fragrance and color are added for sensory appeal, and stabilizers such as suspending agents, anti-

oxidants, and UV stabilizers ensure product longevity and effectiveness.

Classification Of Shampoo

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                          ┌──────────────┐
                          │   SHAMPOO    │
                          └──────┬───────┘
              ┌──────────────────┴──────────────────┐
  ┌───────────────────────────┐        ┌──────────────────────────┐
  │ BASED ON THE APPEAREANCE  │        │  BASED ON THER FUNCTION  │
  └───────────────────────────┘        └──────────────────────────┘
                      ┌────────────────────────┐
                      │  BASED ON THER ORIGIN  │
                      └────────────────────────┘
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1. POWDER SHAMPOO
2. LIQUIDE SHAMPOO
1) CLEAR LIQUIDE SHAMPOO
2) LIQUIDE SHAMPOO
3. GEL SHAMPOO
4. OIL SHAMPOO
5. DRY SHAMPOO

1) CONDITIONING SHAMPOO
2) ANTI DANDRUFF SHAMPOO
3) BABY SHAMPOO
4) CLARIFYING SHAMPOO
5) AEROSAL SHAMPOO

Components	Botanical name	Family	Uses	Image
Tulsi	Ocimum Tenuiflorum	Lamiaceae	Cure fever, treat to heart disease, respiratory problems and skin problems.	
Fenugreek	Trigonella Foenum-Graecum L	Leguminosae	Usedto dandruff, Cardio tonic, diuretic, hypoglycemic and hypertensive.	
Aloevera	Aloe Barbadensis	Liliaceae	Smoothening agent and conditioning agents	
Amla	Emblica Officinalis	Euphorbiaceae	Stimulate hair growth and develops immunity	
Henna	Lawsonia Inermis	Lythraceae	Pacify hair fall, grayingof hair, treat skin diseases	

Soapnut	Sapindus Emarginatus	Sapindaceae	Used as detergent, shampoos, treat skin complaint	
Hibiscus	Hibiscus Rosa-Sinesis	Malveceae	Loss of appetite, cold, flavour, odour, hair growth	
Neem	Azadirachta Indica	Maliaceae	Remove dandruff, hair fall, strengthen, purify blood and improve immunity.	
Shikakai	Acacia Concinna	Leguminosae	Used for hair care, Ayurvedic shampoo, Cleansing, Anti dandruff.	
Vettiver	Chrysopogon Zizanioides	Poaceae	Reduces inflammation and itch, Heal heat rashes, Helps to cool body.	
Bhringraj	Eclipta Prostrate	Asteraceae	Treats hair and skin problems, reduces migraine and blood pressure, Aids scorpion bite.	
Tanners cassia	Cassia Auriculata	Leguminosae	Protects damaging from UV rays, Keeps skin moisturized, reduces hair loss	

METHODOLOGY

MATERIALS AND METHOD

Instruments Names & Supplie

Instruments names & supplier.

S. No	Instruments	Suppliers
1	PH meter	Hasthas scientific instruments
2	Brookfield Viscometer	Labman scientific instruments
3	Hot Plate	Deep Vision
4	Weighing balance	Ishtaa scales
5	Orbital shaker	Hasthas scientific instruments
6	Stalagmometer	Borosilicate glass
7	Heating mandle	Hasthas scientific instruments

1	Citric acid	Nice
2	Gelatin	Nice
3	Sodium lauryl sulphate	Hi-media
4	Methyl paraben	Hi-media
5	Jasmine oil	ASG mantra
6	Lavender oil	ASG mantra
7	Rose oil	ASG mantra
8	Brilliant blue	Noor chemicals
9	Tartrazine	Noor chemicals
10	Sunset yellow	Noor chemicals
11	Bromocresol green	Hi-media
12	Crystal violet	Nice

Chemicals and manufacturer.

S. No	Chemicals	Manufacturer

Formulation.

Ingredients	Formulation 1	Formulation 2	Formulation 3
Amla	5gm	-	-
Cassia	5gm	-	-
Neem	5gm	-	-
Tulsi	5gm	-	-
Bhringraj	-	5gm	-
Fenugreek	-	5gm	-
Henna	-	5gm	-
Vetiver	-	5gm	-
Aloevera	-	-	5gm
Hibiscus	-	-	5gm
Shikakai	-	-	5gm
Soapnut	-	-	5gm
Citric acid	0.1gm	0.1gm	0.1gm
Gelatin	6gm	6gm	6gm
Sodium lauryl sulphate	3gm	3gm	3gm
Methyl paraben	0.1gm	0.1gm	0.1gm

Formulation procedure

Procurement of materials

In this study, various plant parts known for their hair care properties were selected, including Amla, Cassia, Neem, Tulsi, Bhringraj, Fenugreek, Henna, Vetiver, Aloe Vera, Hibiscus, Shikakai, and soapnut. Fresh samples of these plants were sourced from the local market, thoroughly cleaned to remove impurities, then powdered to increase surface area for extraction of active compounds. The powdered plant materials were subsequently passed through a sieve with a mesh size of 60 to ensure uniform particle size, which can enhance their effectiveness in hair care formulations.

Formulation no: 1 (F1)

In the formulation process, 5 ml of the herbal extract was combined with 0.1 g of citric acid and thoroughly mixed into a 6% gelatin solution to create a base. To enhance the foaming properties, 3 g of sodium lauryl sulfate was incorporated, followed by the addition of 0.1 g of methylparaben to provide preservative action. Colorants,

including a small amount of Brilliant Blue and Tartrazine, were added for visual appeal, and jasmine oil was included to impart a pleasant fragrance. Finally, the total volume of the mixture was adjusted to 100 ml using additional gelatin solution, resulting in a hair care product designed to nourish and beautify hair effectively.

preparation of extract: Decoction method

The extraction process for the herbal components, which included Amla, Cassia, Neem, and Tulsi, involved boiling 5 grams of each plant material in 500 ml of distilled water for 4 hours. This prolonged heating allowed for the effective release of beneficial compounds from the plant materials into the water. After the boiling process, the mixture was allowed to cool and then filtered to separate the solid residues from the liquid extract. The resulting extract was a concentrated infusion rich in the hair care properties of the selected plants, suitable for use in various formulations.

Formulation of herbal shampoo

To create the hair care preparation, 5 ml of the herbal extract was combined with 0.1 g of citric acid and mixed thoroughly into a 6% gelatin solution. Then, 3 g of sodium lauryl sulfate was added as a foaming agent, followed by 0.1 g of methylparaben to provide preservative action. To enhance the visual appeal, a small amount of Brilliant Blue and Tartrazine was incorporated, while a sufficient quantity of jasmine oil was added to impart a pleasant fragrance. Finally, the mixture was brought up to a total volume of 100 ml using more gelatin solution, resulting in a well-balanced formula rich in both nourishment and sensory attributes for hair care.

Fmulation no: 2(F2)

The extract was prepared using the decoction method, where 5 grams each of powdered plant materials—Bhringraj, Fenugreek, Henna, and Vetiver—were boiled in 500 ml of distilled water for 4 hours. This extended boiling allowed for the efficient extraction of beneficial compounds from

the plants. After boiling, the mixture was cooled and then filtered to separate the solid residues from the liquid extract, resulting in a concentrated infusion rich in the therapeutic properties of the selected plants, which can be utilized in various applications.

Formulation of herbal shampoo
Formulation no: 3 (F3)

To create the hair care preparation, 5 ml of herbal extract was combined with 0.1 g of citric acid and mixed thoroughly into a 6% gelatin solution. Then, 3 g of sodium lauryl sulfate was added as a foaming agent, followed by 0.1 g of methylparaben to provide preservative action. To enhance the visual appeal, a few drops of bromocresol green and Crystal Violet were incorporated. While a sufficient quantity of lavender oil was added to impart a soothing and calming fragrance, the mixture was finally brought up to a total volume of 100 ml using more gelatin solution, resulting in a well-balanced formula rich in both nourishment and sensory attributes for hair care.

Preparation of extract: Decoction method

The herbal extract was prepared by boiling 5 grams of each powdered plant material—Aloe vera, Hibiscus, Shikakai, and Soapnut—in 500 ml of distilled water for 4 hours. This decoction method facilitated the extraction of beneficial phytochemicals from the plants. After boiling, the mixture was allowed to cool before being filtered, resulting in a concentrated liquid extract that harnesses the natural properties of these plants, known for their uses in skincare and haircare applications.

Formulation of herbal shampoo

To prepare the formulation, 5 ml of herbal extract was combined with 0.1 g of citric acid into a 6% gelatin solution and mixed thoroughly. Next, 3 g of sodium lauryl sulfate was incorporated as a foaming agent, followed by the addition of 0.1 g of methylparaben for preservation. A small

amount of Tartrazine and Sunset Yellow was included for coloring, along with sodium chloride for stability. To enhance the fragrance, a sufficient quantity of rose oil was added, and the mixture was topped up to a total volume of 100 ml using additional gelatin solution, resulting in a richly aromatic and visually appealing hair care product.

Organoleptic evaluation

The prepared herbal shampoo was evaluated for clarity, color, and odor by placing 5 ml of the final formulation in a watch glass against a white background illuminated by a white tubelight. This method allowed for a clear visual assessment of the shampoo's color by the naked eye, ensuring that any hues or turbidity could be accurately observed. Additionally, the odor was subjectively noted, contributing to the overall sensory evaluation of the shampoo's quality and appeal.

Determination of pH

To determine the pH of your 10% shampoo solution, immerse a strip of pH paper in the solution and compare the resulting color against the provided pH key. Alternatively, you can use a calibrated pH meter for a more precise measurement. Most shampoos typically fall within a neutral to slightly acidic range; with a pH less than 7 indicating acidity, which helps the hair cuticle to flatten and appear smoother, while pH values above 7 indicate basicity, leading to increased cuticle swelling and frizziness. A neutral pH of 7 is ideal for maintaining healthy hair, whereas slightly acidic pH values are preferred in shampoo formulations for improved hair texture and manageability.

Determination of percentage solid content

To assess the solid content of the shampoo, begin by weighing a clean, dry evaporating dish, then add 4 grams of shampoo and reweigh the dish to obtain the total weight. Subtract the weight of the dish from this total to determine the exact weight of the shampoo. Place the evaporating dish on a hot plate to evaporate the liquid portion completely, and after drying, weigh the dish again to calculate the weight of the remaining solids. An ideal shampoo should contain between 20% to 30% solids, as having too many solids can make it difficult to apply and rinse out, while too few solids can result in a watery product that washes away too quickly.

Rheological evaluation

The viscosity of the shampoo was measured using a Brookfield viscometer, where 10ml of the shampoo sample was placed in a beaker. A spindle was then immersed in the shampoo for approximately 5 minutes to allow it to reach equilibrium, after which the viscosity reading was taken, providing a quantitative measure of the shampoo's thickness and flowability.

Surface tension measurement To measure the surface tension accurately, a 10% dilution of the shampoo in distilled water was prepared at room temperature. The stalagmometer was meticulously cleaned using chromic acid followed by purified water to eliminate any contaminants, as even small amounts of grease or lubricants can significantly affect surface tension measurements. Once prepared, the data obtained from the stalagmometer can be calculated using the specified equation to determine the surface tension of the shampoo dilution accurately. Please provide the specific equation for further assistance.

Foaming ability and foam stability

The cylinder shake method was utilized to assess the foaming ability of the shampoo. A 1% shampoo solution, specifically 50 ml, was placed in a 250 ml graduated cylinder, which was then covered and shaken vigorously ten times. Immediately following the shaking, the total foam volume was recorded at 1-minute intervals for a duration of 4 minutes to monitor the foam stability and volume over time. This method provides a clear indication of the shampoo's foaming properties and longevity in generating foam.

Wetting time

The experiment involved cutting the canvas into discs with a 1-inch diameter, each having an average weight of 0.44 g. These discs were then placed on the surface of a 1% w/v shampoo solution, and the stopwatch was started to measure the time taken for the disc to begin sinking, which was recorded as the wetting time. This measurement helps evaluate the wetting properties of the shampoo formulation, indicating its effectiveness in allowing the canvas to absorb the liquid.

Dirt dispersion

In this study, artificial hair strands collected from a salon were divided into two batches: a control group that remained unwashed and a test group that was washed with a formulated shampoo at least ten times and air-dried. To evaluate the conditioning effect of the shampoo, a blind touch test was conducted with 20 student volunteers who assessed the hair samples. The conditioning performance was rated on a scale from 1 to 4, with 4 indicating excellent conditioning, 3 good, 2 satisfactory, and 1 poor. This method allowed for unbiased feedback on the effectiveness of the shampoo in conditioning the treated hair.

Conditioning performance evaluation

Artificial hair strands are collected from salon and are divided into two batch(control and test) length 10 cm approximately. The test hair sample is washed with formulated shampoo and control is the one without washing. The test sample has to be washed with shampoo at least for 10 times and sir dried. Blind touch test method is used for determining the conditioning effect of shampoo. About 20 student volunteers are selected and are made to touch the hair samples. The conditioning performance of the shampoo is rated in terms of score1-4 (4-excellent, 3-good, 2- satisfactory and 1-poor).

Cleaning action

To calculate the amount of grease removed from the wool yarn after washing with the shampoo solution, you can use the equation:

Here, the initial weight of the wool yarn is 5 grams, and the final weight is obtained after the yarn is washed, dried, and weighed. The difference between these two weights will give the amount of grease removed, reflecting the effectiveness of the shampoo in cleaning the yarn.

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

In which, DP is the percentage of detergency power, C is the weight of sebum in the control sample and T is the weight of sebum in the test sample.

Eye irritation test

In this study, six albino rabbits were subjected to a 1% shampoo solution applied directly into their eyes, with their eyelids held open using clips. The objective was to assess the potential irritant effects of the shampoo, with observations recorded at specific intervals over an average duration of 4 seconds. Possible reactions included swelling of the eyelid, inflammation of the iris, ulceration, hemorrhaging, and even blindness. This methodology aims to evaluate the safety and tolerability of the shampoo for potential use in products that may come into contact with human eyes.

RESULT AND DISCUSSION

Formulation

Formulation: 1 (F1)

Formulation 1 of the herbal shampoo was created by boiling a blend of neem, tulasi, cassia, and alma in 500 ml of water for 4 hours. After boiling, 5 ml of this herbal extract was combined with a 6% gelatin solution, followed by the addition of 0.1 mg of methyl paraben, 0.1 g of citric acid, and 3 g of sodium lauryl sulfate (SLS) to enhance the formulation's preservative, pH balancing, and surfactant properties, respectively. To achieve a distinct green color indicative of the formulation's quality, tartrazine, brilliant blue, and bromocresol

green were included as indicators. This preparation process results in a final herbal shampoo that combines traditional herbal ingredients with modern cosmetic formulation techniques.

Formulation:2 (F2)

Formulation 2 of the herbal shampoo was developed using bhringraj, fenugreek seeds, vetiver, and henna leaves, which were boiled in 500 ml of water for 4 hours. After this extraction process, 5 ml of the herbal solution was combined with a 6% gelatin solution. To enhance the formulation's stability and effectiveness, 0.1 mg of methyl paraben, 0.1 g of citric acid, and 3 g of sodium lauryl sulfate (SLS) were incorporated. For color indication, 20 drops of bromocresol green and 6 drops of crystal violet were added to achieve a distinct black hue. This meticulous preparation results in a final herbal shampoo designed to leverage the beneficial properties of the selected botanicals while ensuring stability and usability in cosmetic applications.

Formulation:3 (F3)

Formulation 3 of the herbal shampoo was crafted using hibiscus, shikakai, soapnut, and aloe vera, which were boiled in 500 ml of water for 4 hours to extract their beneficial properties. Subsequently, 5 ml of this herbal extract was combined with a 6% gelatin solution for thickening and stabilization. To enhance the shelf life and effectiveness of the product, 0.1 mg of methyl paraben, 0.1 g of citric acid, and 3 g of sodium lauryl sulfate (SLS) were added to the mixture. For color indication, tartrazine and sunset yellow were employed, resulting in a vibrant orange hue. This carefully formulated herbal shampoo effectively harnesses the qualities of the selected ingredients while maintaining a user-friendly and visually appealing product.

Evaluvation

The physical parameters of the formulated herbal shampoos (F1, F2, F3) underwent rigorous evaluation to assess their quality and efficacy. This involved a comprehensive examination of their physical properties, including organoleptic evaluation (sensory assessment of appearance, smell, and texture), pH measurement to determine their compatibility with the skin, percentage of solid content to evaluate stability, rheological evaluation to assess flow behavior and consistency, and surface tension determination to gauge cleansing efficiency. Furthermore, key performance indicators such as foaming ability, foaming stability, wetting time, dirt dispersion test, conditioning performance, and cleaning action were evaluated to assess the formulated shampoos' ability to effectively clean, moisturize, and protect the hair and scalp, ultimately providing a comprehensive assessment of their quality and performance.

Organoleptic Evaluation

The clarity, color, and odor of the prepared herbal shampoo were assessed using a straightforward method. A 5 ml sample of the final herbal shampoo was placed in a watch glass and positioned against a white background under white tube lighting. This setup allowed for an unobstructed visual evaluation, enabling the observer to discern the shampoo's color and clarity clearly with the naked eye. The aroma was also evaluated during this process to determine any noticeable fragrance characteristics associated with the formulation. This sensory evaluation aimed to ensure that the final product met aesthetic and olfactory standards suitable for consumer use.

Examination of colour.

Si. No	Formulation	Colour
1	F1	Green
2	F2	Black
3	F3	Orange

Odour.

Si. No	Formulation	Odour
1	F1	Jasmine
2	F2	Lavender
3	F3	Rose

pH measurement

To determine the pH of the 10% shampoo solution, a strip of pH paper was immersed in the solution, and the resulting color change was compared to a standard pH key for accurate measurement. Alternatively, a calibrated pH meter could be employed for a more precise reading. Typically, most shampoos are formulated to be neutral or slightly acidic; such formulations help maintain hair health by ensuring the cuticle—the outer layer—remains smooth and flat when exposed to acidic conditions, thereby reducing frizz and enhancing shine. Conversely, basic solutions can cause the cuticle to swell and open, resulting in a frizzier appearance. Therefore, evaluating the pH of the shampoo is crucial in predicting its effects on hair texture and manageability.

pH Measurement.

Si. No	Formulation	Ph
1	F1	6.5
2	F2	6.7
3	F3	6.3

Determination of Percentage of solid content

In this experiment, a clean, dry evaporating dish was weighed before adding 4 grams of shampoo, and the combined weight of the dish and shampoo was recorded to calculate the exact weight of the shampoo alone. The dish containing the shampoo was then placed on a hot plate to evaporate the liquid content, leaving behind the solid components. After the drying process, the weight of the remaining solids was measured to evaluate the solid content of the shampoo. Maintaining an optimal balance of solids is crucial; too many solids can make the shampoo difficult to apply and rinse out, while too few can lead to a product that is overly watery and ineffective. Ideally, a well-formulated shampoo should contain between 20% and 30% solids to ensure efficient application and cleansing….

Solid content= [weight of dried sample with china dish – weight of empty china dish] ×100

Percentage of solid content.

Si. No	Fomulation	Solid Content (%)
1	F1	26
2	F2	28
3	F3	27

Rheological evaluation

The viscosity measurement of the shampoo using a Brookfield viscometer involves immersing the calibrated spindle into a 10ml sample in a beaker for approximately 5 minutes to ensure complete interaction with the formulation. After this time, the viscometer provides a reading that reflects the flow resistance of the shampoo, allowing for an assessment of its consistency and suitability for application.

Rheological evaluation.

Si. No	Formulation	Rheological Evaluation (Mpas)
1	F1	17.5
2	F2	20.1
3	F3	14.4

Surface tension measurement

It appears you're discussing a surface tension measurement experiment using a stalagmometer, which is a device used to measure the surface tension of liquids. You've mentioned thoroughly cleaning the stalagmometer with chromic acid and purified water to remove any grease or impurities, as surface tension can indeed be affected by such contaminants. The data is likely being calculated using a specific equation related to capillary action, contact angle, or another relevant principle governing the behavior of liquids in the stalagmometer.

Surface tension.

Si. No	Formulation	Surface Tension
1	F1	1.00146
2	F2	1.01085
3	F3	1.00446

Foaming ability and foaming stability

The cylinder shake method is being used to determine the foaming ability of a 1% shampoo solution, where 50ml of the solution is placed in a 250ml graduated cylinder, shaken 10 times, and

the total volume of foam is recorded at 1 minute, and then at 1-minute intervals for 4 minutes, allowing for the calculation of foam volume and its stability over time, providing an assessment of the shampoo's foaming properties and how they change as the foam settles.

Foaming ability and stability:

Formulation	Ml	Height Of Foam
Formulation 1	1ml	0.7cm
	2ml	0.6cm
	3ml	0.7cm
	4ml	0.5cm
	5ml	0.5cm
Formulation 2	1ml	0.9cm
	2ml	1.0cm
	3ml	1.3cm
	4ml	1.1cm
	5ml	1.3cm
Formulation 3	1ml	0.5cm
	2ml	0.8cm
	3ml	0.4cm
	4ml	0.9cm
	5ml	1.1cm

Wetting time

This procedure appears to be assessing the wetting time of a canvas material when submerged in a 1% shampoo solution. The canvas discs, with an average weight of 0.44g, are floated on the surface of the shampoo solution, and the time is measured until the disc starts to sink, which is recorded as the wetting time. This test can be used to evaluate the ability of the shampoo solution to wet and penetrate the fabric, indicating its efficiency and effectiveness in cleaning and wetting surfaces.

Wetting time:

Si. No	Formulation	Wetting Time
1	F1	13 seconds
2	F2	15 seconds
3	F3	14seconds

Dirt dispersion

The experiment evaluates the quality of different shampoos by adding two drops of shampoo and one drop of India ink to 10 ml of distilled water in a test tube, which is then shaken. The amount of ink found in the foam is categorized as None, Light, Moderate, or Heavy. A higher concentration of ink in the foam indicates poor-quality shampoo, as effective shampoos should allow dirt to remain in the water phase, preventing it from redepositing on hair during rinsing.

Dirt dispersion:

Si. No	Formulation	Dirt Dispersion
1	F1	None
2	F2	None
3	F3	None

Conditioning performance evaluation

In this study, artificial hair strands from a salon are divided into control and test groups, both measuring approximately 10 cm in length. The test group undergoes 10 washes with a formulated shampoo, while the control group remains unwashed. After drying, a blind touch test is conducted with 20 student volunteers who assess the conditioning effect of the shampoo on the test samples. The conditioning performance is rated on a scale from 1 to 4, with 4 indicating excellent performance and 1 indicating poor performance.

Conditioning performance.

Si. No	Forumation	Conditioning Performance
1	F1	Excellent
2	F2	Excellent
3	F3	Excellent

Cleaning Action

To calculate the amount of grease removed from the wool yarn after washing with the shampoo solution, you can use the following equation:

Amount of grease removed =Initial weight of wool yarn + Weight of grease - Final weight of wool yarn. In this case, the initial weight of the wool yarn is 5 grams, the weight of the grease initially present should be specified, and the final weight of the wool yarn after drying will be measured. Substituting these values into the equation will provide the amount of grease removed during the washing process.

DP = 100 (1-T/C)

In which, DP is the percentage of detergency power, C is the weight of sebum in the control sample and T is the weight of sebum in the test sample.

Cleaning action:

Si. No	Formulation	Cleaning Action
1	F1	30.7%
2	F2	32.9%
3	F3	31.7%

Eye Irritation Test

This description appears to be referring to the Draize eye irritation test, a common method used to assess the potential irritation and toxicity of chemicals, including shampoos, on the eyes of animals, usually rabbits. In this test, a 1% solution of the shampoo is dripped into the eyes of six albino rabbits, and the eyes are held open with clips to prevent blinking. The test observes and records any damage to the eyes, such as swelling, inflammation, ulceration, and bleeding, over a specific time period (typically 24-48 hours), in order to predict potential eye irritation in humans.

Eye irritation test:

Si. No	Formulation	Eye Irritation Test
1	F1	No Irritation
2	F2	No Irritation
3	F3	No Irritation

CONCLUSION

The study aimed to formulate and evaluate a polyherbal shampoo specifically designed for treating hair loss, utilizing plant extracts known for their traditional hair cleansing properties in Asia. The formulation includes ingredients selected for their preservative qualities and effectiveness in preventing hair loss, addressing the growing consumer demand for herbal products with minimal side effects. Various physicochemical tests were conducted to assess and compare the quality of the formulations, revealing that the polyherbal shampoo samples (F1, F2, F3) met quality control standards. Among these, formulation F2 emerged as the most effective and safest option for use, indicating its potential for further development and improvement.

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