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Research Article

Formulation And Evaluation Of Herbal Anti-Dandruff Shampoo

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ABSTRACT

The main aim of the present study is to formulate and evaluate herbal Anti dandruff shampoo containing natural ingredients with an emphasis on safety and efficacy. It clears dirt, dandruff, promotes hair growth, lustre, strengthens and darkens the hair. The shampoo sector is probably the largest unit of among the hair care products. Since the shampoos are one of the cosmetic product used in daily as the hair is special and cherished feature of humans. Majority of ingredients in the shampoos are chemicals and hence have been under severe attack due to its potential risk of side effects with its usage. The main objective of this study is to eliminate harmful synthetic ingredients from anti-dandruff shampoo formulation and substitute them with safe natural ingredients. An attempt has been made to combine modern formulation technology into a formula based on natural ingredients. The shampoo was prepared by taking the extracts of Orange peel powder (*Citrus Aurantium Dulcis-Rutaceae*), Curry Leaves (*Murraya Koenigii-Rutaceae*), Aloe Vera (*Aloe Barbadensis Miller-Asphodelaceae*), Reetha (*Sapindus Mukorossi-Sapindaceae*) in different proportions. Several physicochemical tests were performed for visual assessment, wetting time, pH, assurance of solid contents, surface tension, detergency, dirt dispersion, foam stability.

INTRODUCTION

HAIR:

- Hairs are the integral part of human beauty.
- Hair is a protein filament that grows from follicles on the dermis or skin.
- Scientific name of hair is pili or pilus.
- Hair is a component of the integumentary system and extends downward into the dermal layer where it sits in the hair follicle.
- The presence of hair is a primary differentiator of mammals as a unique class of organisms. In humans, it is a cherished and highly visible indicator of health, youth, and even class.

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- It has a sensory function, protects from cold and UV radiation, and can have a significant psychological impact when its growth or structure is deranged.[1]

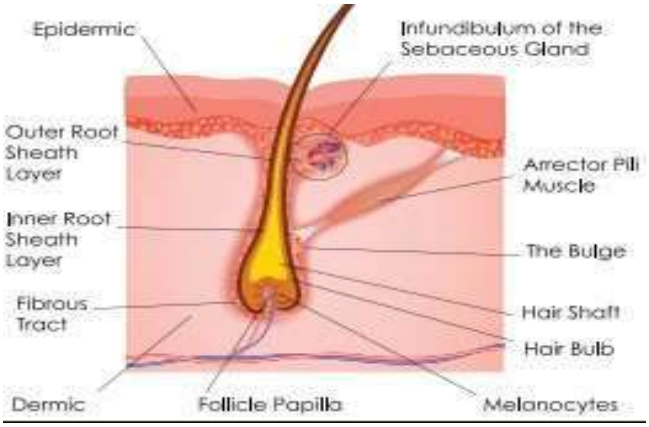

Fig.no: 1 Structure of hair

Hair Anatomy:

- Hair grows from hair follicles situated within the fatty layer of the scalp. Contrary to the popular belief that hair grows as single strands, hair follicles actually grow in groups of 1-4 hairs called "follicular units".
- At the base of each hair follicle is a hair bulb where the growth mechanism for producing hair occurs. Hair follicles get their nourishment from the blood vessels within the dermis. The cells divide and develop to produce the hair shaft.
- While the hair is still developing underneath the epidermis, it maintains a soft form. Once the pushes past the epidermis, its outside layer hardens into keratin.

Parts of the Hair:

Dermal papillae: The dermal papilla is responsible for regulating the hair cycle and hair growth, and is also comprised of androgen receptors that are sensitive to the presence of DHT.

Matrix: The matrix surrounds the dermal papillae and contains all the active cells needed for hair growth and for the development of the different parts of the hair, particularly the outer root sheath, the inner root sheath and the hair shaft. Combined, the matrix and the dermal papillae make up the hair bulb.

Outer root sheath: The outer root sheath, or trichilemmal, is the outermost part of the hair and is keratinized. It covers the entire hair follicle inside the dermis and then transitions through to the epidermis, providing the hair follicle with an opening from which to surface from.

Inner root sheath: inner root sheath is comprised of three parts: the Henley layer, Huxley layer, and cuticle. The Henley's and Huxley's layers are capsular layers that anchor onto each other with the purpose of stabilizing the hair. The cuticle, which is the innermost part that it closest to the hair shaft, is made from dead hardened cells and give the hair shaft added protection. This, together with the capsular layers that make up the Henley's and Huxley's layers, secures the hair and allows it to grow in length.

Hair shaft: The hair shaft is the solitary part of the hair follicle that fully exits the surface of the skin. The hair shaft is made up of three layers: the medulla, cortex, and the cuticle.

- The medulla is described as an unsystematic and unstructured area located in the innermost region of the hair shaft and is not always present.
- The cortex, in contrast to the medulla, is highly structured and organized. The cortex is made up of keratin and is responsible for giving hair its strength and durability, as well as its water uptake. The cortex also contains melanin and determines the colour of hair based on the number, distribution and types of melanin granules present.
- The cuticle is the hair's outer protective layer and is connected to the internal root sheath. It is a complex structure with a single molecular layer of lipids that helps hair repel water[2].

HAIR PHYSIOLOGY

Hair growth cycle:

Hair growth is a unique and complex process that involves continuous cycles of growth and regeneration (anagen phase), transition (catagen phase), and resting (telogen phase). The cyclic activity continues throughout life; but the phases of the cycle change with age.

Fig.no:2 Structure of hair growth cycle

Anagen phase:

During this phase, new hair is produced in the lower part of the hair follicle. Normally, most of the scalp hairs (approximately 85-90%) are in their anagen phase at any time, while the remaining 10% is in the telogen or catagen phase. On the scalp, the anagen phase can last 2-6 years11; however, in some cases, it may be longer (even 8 years**).**

The longer the anagen phase, the longer the hair is able to grow. The difference in individual's hair length can be related to the varying length of the anagen phase. Scalp hair grows at a normal rate of about 1mm every 3 days. The hair on the arms, legs, eyelashes, and eye brows have a much shorter anagen phase and a slower growth rate, explaining why it is much shorter than the scalp hair (the general length is in the range of1-3 cm.

Catagen phase:

It is a brief transition phase between the growth and the resting phases, which marks the end of the growth phase. On the scalp, the catagen phase usually lasts between 2 and 3 weeks.

During this phase, cell division stops, the follicle tube shrinks and detaches from the dermal Papilla, and the base of the follicle moves upward toward the surface of the skin. Melanin Production stops in this phase, leading to a non-pigmented lower end in the hair (which is under the scalp until it falls off).

Telogen phase:

This is the final phase and lasts until the fully grow hair is shed. Although the telogen phase is called the resting phase, many activities occur during this phase, which allows the hair Shaft to be shed and stimulates the conditions essential for regrowth. The hair either shed during the telogen phase or remains in place until the next anagen phase, when the new hair growing in pushes it out. On the scalp, the telogen phase usually lasts for approximately2-3 Months. As soon as the telogen phase ends, the hair returns to the first phase and the entire cycle begins again. New hair appears from the same follicle. Removal of telogen hairs is easy and painless; these are the hair follicles that come out during shampooing.[3]

PROBLEMS RELATED TO HAIR:

- Dandruff
- Dry hair
- Split ends
- Oily hair
- Frizzy hair
- Limp hair
- Hair loss
- Heat damage
- Colour damage
- Grey hair
- Heat damage hair
- Scalp infection[1]

DANDRUFF:

- It is a harmless, chronic condition that occurs when the scalp becomes dry or greasy and produces white flakes of dead skin that appear in the hair or on the shoulders.
- It is a harmless, chronic condition that occurs when the scalp becomes dry or greasy and produces white flakes of dead skin that appear in the hair or on the shoulders.
- Although it is harmless, dandruff can be embarrassing for those who have it.
- Skin cells are formed continuously on the scalp, so the shedding of the dead skin cells is

normal process. With dandruff, however skin cells are shed at a faster rate than normal. oil from the scalp causes the skin cells to clump together and appear as white flakes.[4]

CAUSES OF DANDRUFF:

- Dry skin.
- Irritated, oily skin.
- Not shampooing often enough.
- Malassezia is a yeast like fungus that feeds on oils on the scalp of most adults.
- Sensitivity to hair products.
- Skin disorder.

TREATMENT:

- Follow a healthy diet
- Keep your hair clean
- Stay hygienic[3]

SHAMPOO:

A Shampoo is a preparation of a surfactant in a suitable form -liquids, solid or powder- which when used under the specified conditions will-

- Remove surface grease.
- Dirt removed.
- Skin debris from the hair shaft and scalp without adversely affecting the user.

ACTION OF SHAMPOO:

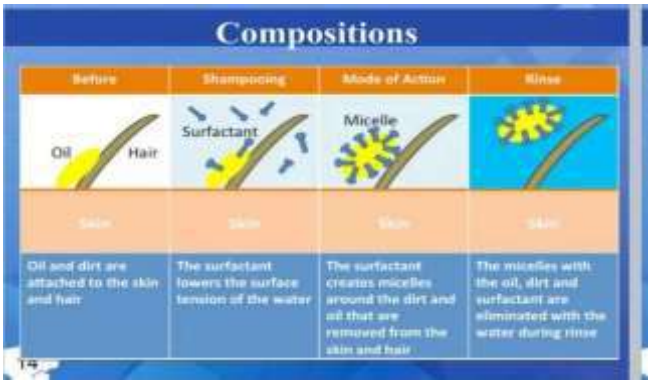

Fig.no:3 Action of shampoo

ADVANTAGES OF SHAMPOO:

- Cleansing properties.
- Improving hair hygiene.
- Treating scalp conditions.
- Treatment for dry scalp.
- Treatment for hair loss.
- Treatment for greasing or oily hair.
- Relieves itch and irritation.
- Repairs damaged hair.
- Shampoo keeps hair silky or smooth.
- Keeps your hair beautiful and blossomed.

IDEAL PROPERTIES OF SHAMPOO:

- To make the hair smooth and shiny.
- Produce good amount of foam.
- Should not cause irritation to scalp, skin and eye.
- Should completely, effectively remove dirt.
- Impart pleasant fragrance to hair.
- Good biodegradability.
- Low toxicity.[5]

TYPES OF SHAMPOO:

I. Powder shampoo
II. Liquid shampoo
III. Cream shampoo
IV. Jelly shampoo
V. Aerosol shampoo
VI. Keratin shampoo
VII. Volumizing shampoo
VIII. Specialized shampoo

I. Powder shampoo:

It is available in the form of dry powder, initially it was prepared from dry soaps, but nowadays dry synthetic detergents are used for their preparation. Powder shampoo is prepared where addition of water or other solvent reduces the activity of the components, especially in case of medicated shampoo. Nowadays, these shampoos are not used due to the difficulty experienced in their application.

II. Liquid shampoo:

These are clear liquid preparations that are most widely used. They are usually made by using detergent of low cloud point. Some of these shampoos may be transparent.

III. Cream shampoo:

These are called as lotion shampoos which are modification of clear liquid cream shampoos. Solubilising agents such as magnesium stearate is also used to dissolve the added opacifier.

IV. Jelly shampoo:

These are transparent and thick usually made by incorporating a gelling agent, (e.g., cellulose). Ther is great use in hair salons and beauty parlours. The principle ingredient is detergent which can be used either alone or in combination with soap. By altering the proportion of detergent, gel of required consistency can be obtained. Addition of methyl cellulose to clear liquid shampoo and its subsequent thickening also gives rise to gel shampoo.

V. Aerosol shampoo:

Preparation and packings complicated as an additional propellant is included. The propellant added must be compatible and should not reduce the activity of shampooing ingredients. The container opening is provided with a valve. They are called aerosol shampoos because they are packed in aerosol containers. Their formulation, Shampoo comes out as foam when the valve is pressed. Hence also called as foam type shampoo.

VI. Keratin shampoo:

When your shampoo (or any hair care product) is infused with keratin oil, you reap benefits that nourish and condition the hair. This helps it look shiny and smooth. It also helps to fight frizz, tame fly always, and protect against damage caused by styling tools like a straightening iron or blow dryer.

VII. Volumizing shampoo:

Volumizing or volume shampoos make hair appear fuller, bouncier and morefull of body. It's more about the texture of the hair than the thickness of the hair strands. Instead, volumizing shampoos should be lightweight enough to not weigh down your hair, thus creating more body.

VIII. Specialised shampoo:

Speciality shampoos are marketed to people with dandruff, colour-treated hair, gluten or wheat allergies, an interest in using an organic product, infants and young children ("baby shampoo" is less irritating).

A. Conditioner
B. Anti-dandruff
C. Baby
D. Two layer
E. Anti-hair fall[1]

BENEFITS OF HERBAL ANTI-DANDRUFF SHAMPOO:

- It prevents dandruff and soothes the scalp.
- It reduces hair fall.
- It cleanses your hair, makes it feel soft and smooth.
- It repairs and nourishes your hair.
- Removes acne scars and blemishes.
- Prevents sun damage.
- Leave-in conditioner.
- Intense moisturizer with a light texture.[6]

HERBAL SHAMPOO:

They 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 pollution, etc.

IDEAL PROPERTIES OF HERBAL SHAMPOO:

- It is necessary to generate a sufficient amount of foam to meet the psychological needs of the user.
- It can be easily removed by rinsing with water.
- Keep your hair dry, soft and shiny, easy to handle and minimize splattering.
- It should give your hair a pleasant scent.
- Do not cause side effects or irritation to the skin or eyes.

ADVANTAGES OF HERBAL SHAMPOO:

Herbal shampoo was formulated by pure and organic ingredients with no synthetic additives or surfactants are free of any side effects.

- Herbal shampoos are biodegradable and earth friendly.
- It doesn`t cause irritation to the eyes.
- It is cost friendly, not much expensive.

- Regular usage of herbal shampoo can do wonders for your hair.
- A perfect oil balance is achieved by using herbal shampoo.
- They consist of national essential disinfectant properties that protect hair and scalp from

METHODOLOGY

Materials

Collection of plants:

The parts of plants like orange peel (powder), Reetha (powder), and lemon were collected from the local market. Curry patta(leaves) and Aloe vera (leaves), were obtained from local nursery. These were washed under running water to remove contaminants. Curry patta is dried in sunlight, converted into coarse powders and sieved using 60 meshes. The extracts were prepared by decoction method and the prepared extracts were stored in well-closed containers.

A. CHEMICALS:

SLS, Glycerine, 0.1M NaCl and Acacia gum was collected from laboratory of Farooqia college of pharmacy, Mysuru.

EQUIPMENTS:

Calibrated PH Meter, Ostwald viscometer, Volumetric flask, Whatman filter paper, Separating funnel, Beaker, Test tube, Stalagmometer, Weight scale, Canvas paper, Specific gravity bottle, Burette stand.

FORMULATION OF HERBAL ANTIDANDRUFF SHAMPOO: 6-12

Preparation of herbal extract: (DECOCTION METHOD)

Each powered crude drug was taken, Weight 5gm of each powder and pour 100ml of water in to beakers. The mixture was kept for boiling until the water reduced to one quarter, The above mixture is then filtered and then the filtrate is collected And then stored in tight containers.

Fig no:4 Aqueous extracts of crude drug

PREPARATION OF ANTI-DANDRUFF SHAMPOO:

The anti-dandruff shampoo was formulated using simple mixing process. Formulations were made by using Reetha powder, Orange peel powder, Aloe vera and curry leaves extracts. The other ingredients used are Sodium lauryl sulphate as surfactant. 0.1M Nacl is used as a thickening agents, Lemon juice is used as a preservative, Soap-nut is anti-microbial agents as well as foaming agents, Glycerine which act as a humectant, Which pulls moisture from hair and keeps hair hydrated and healthy, Acacia (gum) act as increase the viscosity and anti-fungal agent, which prevent fungal spread.

SL.NO	INGREDIENTS	F1	F2	F3	F4
1	Curry leaves extract	1 ml	1.5ml	2ml	2.5ml
2	Aloe Vera extract	1ml	1.5ml	2ml	2.5ml
3	Orange peel extract	1ml	1.5ml	2ml	2.5ml
4	Reetha extract	1ml	1.5ml	2ml	2.5ml
5	SLS	3gm	3gm	3gm	3gm
6	Glycerine	1ml	1ml	1ml	1ml
7	Lemon juice	0.5ml	0.5ml	0.5ml	0.5ml
8	Acacia	0.5gm	0.5gm	0.5gm	0.5gm
9	0.1M NaCl	2ml	2ml	2ml	2ml
10	Water	Q.S.	Q.S.	Q.S.	Q.S.

Table no: 1 Formulation of herbal anti-dandruff shampoo

EVALUATION OF HERBAL ANTI-DANDRUFF SHAMPOO:

- **Organoleptic characteristics of powders:**

Sl no.	Characteristic	Aloe Vera gel	Reetha Powder	Orange peel Powder	Curry leaves Powder
1	Colour	White to off white Cream	Brown colour	Brownish-yellow colour	Dark green
2	Odour	Odourless	Slight herbal scent	Orangey/ tangerine	Strong and refreshing aroma
3	Taste	Tasteless	Bitter in taste	Bitter in taste	Bitterish taste, sweet pungent aroma
4	Solubility	Soluble inwater	Soluble in water	Soluble in water	Soluble inwater, Soluble inalcohol

Table no 2: Organoleptic characteristics of powder

- **Physical appearance/visual inspection:** The formulation prepared was evaluated for the clarity, colour and foam producing ability and fluidity.
- **Determine percent of solid contents:** A clean dry evaporating dish was weighed and added 10 grams of shampoo to the evaporating dish. The dish and shampoo were weighed. The exact weight of the shampoo was calculated and evaporating dish with shampoo was placed on hot plate until the liquid portion was evaporated. The weight of the shampoo after drying was calculated.
- **Determination of pH:** P^H of 10 % shampoo solution is evaluated. Dip one stripe of pH paper into the solution and compare the stripe colour to value. After calibration the pH meter can be used. Most shampoos are slightly acidic, or neutral. Acidic solutions cause hair cuticular (outer layer) to shrink and lay flatter on the hair shaft.

Tab No.3 Evaluation of Formulation for Physical Appearance and Solid Content

SL. NO.	Formulation	Physical appearance	Solid contents
1	F1	Yellowish green	0.86 gm
2	F2	Yellowish green	2.34 gm
3	F3	Slightly green	1.70 gm
4	F4	Green	0.59 gm

Fig no:5 Determine percent of solid contents

- **Foaming ability and Foam stability:**

Cylinder shake method was used for determining foaming ability. 10ml of 1% shampoo solution was put into a 10 ml measuring cylinder and is shaken for 10 times. The total volumes of foam contents after 1minute shaking were recorded. The foam value was calculated immediately after shaking the

volume of foam at 1-minute intervals for 4 minutes were recorded.

Tab No:4 Determination of Foam value

Sl NO.	Formulation	Foam Volume and Foam Stability
1	F1	15-14.6 ml
2	F2	15-14 ml
3	F3	32-28 ml
4	F4	16-15 ml

Fig no:6 Foaming ability of different formulations

- **Rheological evaluation:**

The viscosity of the shampoos was determined by using Ostwald viscometer. The viscometer was cleaned with water and then it was cleaned with acetone, rinse with water again and ether and then dry. Attach the viscometer to the burette stand in exactly vertical position. Fill the shampoo in the lower bulb of the viscometer till the bulb fills completely. Suck the shampoo from other end through rubber tube above mark(A). Allow it to flow freely. Start the stopwatch as soon as the upper layer of shampoo crosses mark A and stop the stopwatch as soon as it crosses mark (B). Repeat the recording with other formulations and record the timing.

Tab no:5 Evaluation of viscosity

SL NO.	FORMULATION	TIME
1	F1	2 min 02 sec
2	F2	8 min 28 sec
3	F3	4min 14sec
4	F4	5 min 34 sec

Fig no:7 Determination of viscosity

Determination of Surface Tension using Stalagmometer (Drop Count Method):

- Select a clean stalagmometer fix firmly in vertical position and suck the water through the rubber tube to a level higher than the upper mark.
- Leave the rubber tube allow water tube allow water to flow down.
- Start counting 20-30 drops when water just passes the upper mark, into a clean vessel.
- Note the weight of n drops and then calculate the mean weight of drops of water(W2).
- Repeat the process with the liquid whose surface has to determined and note the mean weight of drops as (W1).

*Weight of empty specific gravity bottle(W1) = 18.95gm

Table no. 6 Weight of specific gravity bottle in evaluation of surface tension

SL NO.	Formulation	Weight of specific gravity bottle
1	Water(W2)	44.87 gm
2	F1(W3)	45.53 gm
3	F2(W3)	46.21 gm
4	F3(W3)	46.57 gm
5	F4(W3)	46.88 gm

Tab no: 7 Number of drops falling from upper mark to lower mark and surface tension

SL. NO	Formulations	No of drops	Average	SurfaceTension dynes/cm
1	F1	70,71,71	70.6	37.26
2	F2	75,74,75	74.6	39.23
3	F3	87,88,87	87.3	47.36
4	F4	93,92,93	92.6	49.13

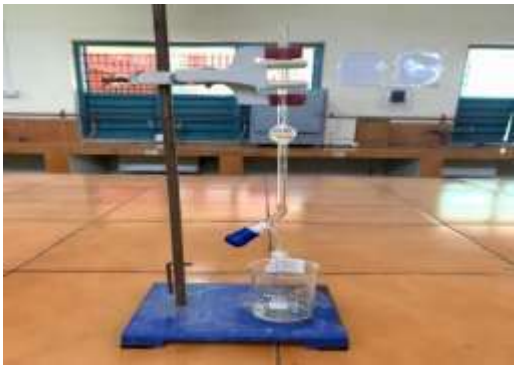

Fig no:8 Determination of surface tension

Washability:

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

Washability of different formulations is good.

- **Dirt dispersion:**

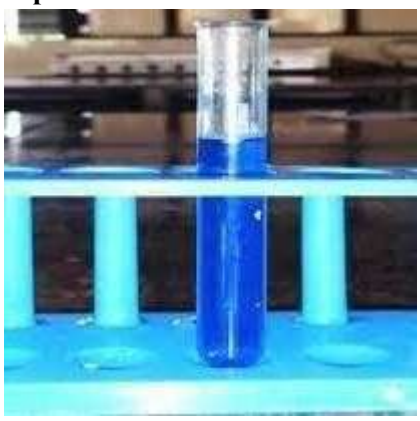

Fig.no.9 Dirt dispersion

Two drops of shampoo were added in a large test tube containing 10 ml of distilled water, to this add 1 drop of India ink was added. The test tube is then stoppered and shaked for several mins. The amount of ink in the foam was estimated as None, Light, Moderate, or Heavy.

Dirt dispersion of different formulations is moderate.

- **Wetting time**:

A canvas paper was cut into require dimensions with an average weight of 0.44gm. The smooth surface of the disc was placed on the surface of the shampoo solution and the stopwatch was started. The time required for the disc to begin sink was noted down as the wetting time. Wetting efficiency is considered to be higher if the disc takes less time for sinking.

Wetting time of different formulations are 6,10,13 and 14 secs.

RESULT AND DISCUSSION

The aim of the present work is to formulate and evaluate herbal anti-dandruff shampoo by using Curry leaves, Aloe vera gel, Orange peel and Reetha powder by various combinations. Organoleptic characteristic of above herbs was evaluated which includes their colour test, Solubility and P^H. All the crude drugs powders are extracts by decoction method and the prepared extracts were store in well-closed container and then through simple mixing process different formulations were prepared and their evaluations parameters were evaluated.

Physical appearance/visual inspection:

The formulations prepared appeared yellowish green, yellow green, slightly green and green colour.

Determination of pH:

At room temperature 27^0C, the pH of 10 % shampoo solution in distilled water was measured and the pH range was found to be 6.3 to 6.6.

Dirt Dispersion:

Shampoo that causes the concentration of the ink in the foam is considered as poor quality. The dirt should remain in the water itself. Dirt that remains in the foam can be hard to clean out and it is going to get redeposited on your head. The shampoo which is formulated shows moderate results.

Determine percent of solid contents:

The shampoo weight was measured for all formulations after drying and the range was found to be 0.86g, 2.34g, 1.70g and 0.59g.

Surface tension measurement:

Measurements were performed at room temperature with different formulations of shampoo and the range was found to be 37.26 dynes/cm, 39.23 dynes/cm, 47.36 dynes/cm, 49.13 dynes/cm.

Wetting time:

A surfactant's wetting ability depends on its concentration and is commonly used to test its effectiveness. Wetting time of different formulations was found to be 6,10,13 and 14 secs.

Viscosity measurement:

Viscosity of the different formulations were found to be 2 min 02secs, 8 min 28 secs, 4 min 14 secs and 5 min 34 secs.

Foaming ability: Foaming ability of different formulations were found to be in the range of 15-16ml.

Sl no.	Characteristic	Aloe Veragel	ReethaPowder	Orange peel Powder	Curry leavesPowder
1	Colour	White to off white Cream	Brown colour	Brownish-yellow colour	Dark green
2	Odour	Odourless	Slight herbalscent	Orangey/ tangerine	Strong andrefreshing aroma
3	Taste	Tasteless	Bitter in taste	Bitter in taste	Bitterish taste, sweet pungent aroma
4	Solubility	Soluble inwater	Soluble inwater	Soluble in water	Soluble inwater, Soluble inalcohol

Table no8: Organoleptic characteristics of powder

Evaluation parameter	F1	F2	F3	F4
Solid contents	0.86g	2.34g	1.70g	0.59g
Viscosity	2 min 02 secs	8 min 28 secs	4 min 14 secs	5 min 34 secs
Surface Tension	1.021g/cc	1.04g/cc	1.055g/cc	1.07g/cc
Foaming ability	15-14.6ml	15-14ml	32-25ml	16-15ml
Washability	Good	Good	Good	Good
Wetting Time	6 secs	10 secs	13 secs	14 secs
Dirt Dispersion	Moderate	Moderate	Moderate	Moderate
pH	6.3-6.6	6.3-6.6	6.3-6.6	6.3-6.6

Table no: 9 Evaluation parameters of different formulations

CONCLUSION

The formulation of herbal anti-dandruff shampoo provides a method for treating dandruff on a scalp. In this study, efforts have been made to prepare and evaluate herbal antidandruff shampoo by using various combinations. Herbal anti-dandruff hair shampoo containing 1ml (F1) of herbs concentration of Curry leaf extract, Aloe vera gel, Orange peel extract, Reetha extract with sodium lauryl sulphate base could be used as an effective in treatment of dandruff on scalp. The formulated shampoos were not only safer than the chemical dandruff agent, but it may greatly reduce the hair loss during combing as well as strengthen the hair growth.

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