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FORMULATION AND INVITRO EVALUATION OF POLYHERBAL DRY SHAMPOO POWDER

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ABSTRACT

The demand for herbal-based cosmetics and personal care products has increased significantly due to consumer preferences for natural, safer, and environmentally friendly alternatives. This study focuses on the formulation, preparation, and in vitro evaluation of a polyherbal dry shampoo powder using Rosmarinus officinalis (rosemary), Acacia concinna (shikakai), and Allium cepa (onion) as key ingredients. The primary objective was to develop a natural and chemical-free alternative to synthetic shampoos that could efficiently cleanse the scalp, remove excess oil, and promote healthy hair growth. The dry shampoo was formulated by blending herbal powders with absorbents and bulking agents. The preparation process involved drying, grinding, and sieving the raw herbal materials to achieve a uniform powder consistency. The powdered herbal blend was mixed with absorbent and stabilizers like arrowroot powder, foaming agent like Reetha powder, preservative like neem powder, and conditioning agent like aloe vera powder. To evaluate the effectiveness of the polyherbal dry shampoo, various in vitro tests were conducted. These tests include pH, wetting time, foaming index, and foaming capacity. The overall results of the study indicate that the polyherbal dry shampoo powder using rosemary, shikakai, and onion is a viable alternative to conventional liquid shampoos, offering several benefits such as easy application, portability, and scalp health improvement. The product is suitable for individuals with busy lifestyles, and people with scalp sensitivity who prefer natural products.

KEYWORDS: Portability, Conditioner, Bulking agent, consistency, etc.

INTRODUCTION

Human beauty is largely derived from the hair. Herbs have been used by humans for hair care, cosmetics, and cleaning since ancient times. Although hair has been styled, cut, and even coloredsince the beginning of time, cleaning has not received as much attention as it should.[1] Hair serves as a barrier of defense against outside influences. This is especially true when it comes to scalp hair providing UV protection. The ability of an ingredient to prevent skin damage and to improve skin quality by washing, nourishing, and protecting the skin are the two main criteria for selecting an active ingredient for powder hair shampoo.[2]

Despite the vital role of scalp hair as a defensive barrier and its contribution to overall physical appearance, it is believed that hair care is not taken as seriously as skin care.[3] Hair shafts majorly consist of cortex, cuticle cells, and medullary cells, whereas hair follicles are essential for the generation of hair.[4] Hair care products may be defined as medicines meant for sanctification, modifying the texture, changing the color, giving life to the stressed-out-out hair, furnishing aliment to the hair, and giving a healthy look to the hair. There are colorful types of hair normal hair, unctuous hair, and dry hair, varies from one person to another person.[5]

In light of the recent developments in the scientific and technological world, indeed moment sources are extensively used as remedial agents. India is one of the countries in this artificial world that is rich in large kinds of medicinal plants.[6] At this Moment we're witnessing a great deal of public interest in the use of herbal remedies. The herbal drug is grounded on the premise that plants contain natural substances that can promote health and alleviate illness.[7]

In herbal drugs the term sauces is used approximately to relate not only to herbaceous shops but also to dinghies; roots; leaves; seeds; flowers and fruit of trees, shrubs, and woody vines; and excerpts of the same that are valued for their savory, sweet, or medicinal rates. The

botanical term condiment refers to seed-producing shops with nonwoody stems that die down at the end of the growing season, shops have played a significant part in maintaining mortal health and perfecting the quality of mortal life for thousands of times, and have served humans well as precious factors of seasonings, potables, cosmetics, colorings, and drugs. The World Health Organization estimated that <80% of the earth's inhabitants rely on traditional medicine for their primary healthcare needs, and most of this therapy involves the use of plant extracts or their active components.[8]

Herbal dry shampoo powder is a natural alternative to traditional liquid shampoo. The application and efficacy of dry shampoo powder are altered when combined with water to createa paste. This mixture can be used to target certain areas more specifically or to cleanse the scalp more thoroughly. When applied and massaged into the scalp, the paste can provide a deeper clean by physically eliminating oil and debris. When compared to powder alone, it also enablesa more regulated application.[9]

BENEFITS OF HERBAL DRY SHAMPOO POWDER

- Polyherbal dry shampoo powder prevents oily locks between the scalps by cleansing your hair.
- Reducing the frequency of hair washing can also lessen the need for heating tools like hair.
- Dryers and curling or straightening irons, which can cause damage to your hair.
- Polyhebral dry shampoo powder enhances the appearance of hair and improves thickness of hair.
- Polyhebral dry shampoo powder reduces damage to hair.
- Polyherbal dry shampoo powder is devoid of artificial additives and adverse effects.
- Polyherbal dry shampoo powders don't contain any products made of petroleum.[10]

ROSEMARY

Taxonomic classification

Kingdom: Planate
Phylum: Magnoliophyta
Class: Magnoliopsida
Subclass: Asteridae
Order: Lamiales
Family: Lamiaceae
Genus: Rosmarinus
Species: Rosmarius officinalis.

Rosemary or Rosmarinus officinalis Linn (Labiatae) is an aromatic herb surrounded by tradition and leg- ends but with important culinary, medicinal, and cosmetic properties. In folk medicine, it is used to stimulate the growth of hair as a rinse.[11] The most important constituents of rosemary are thought to be caffeic acid and its derivatives such as rosmarinic acid; these compounds have antioxidant effects.[12]

Rosemary (Rosmarinus officinalis) is an evergreen shrub with upright sterns, whitish-blue flowers, and dark green leaves that have rolled edges containing sweet oils. Native to the Mediterranean coast and sub-Himalayan areas, it's been cultivated since ancient times in various countries. Rosemary is a symbol of love, marriage, birth, and death, and is used in nuptial bouquets and to cover against evil influences. It's also used to repel moths and add an affable odor. The Latin name" Rosmarinus" means" Dew of the Sea". This seasoning has been mentioned in classic factories like Hamlet and Don Quixote, pressing its cultural significance.[13]

Application of rosemary

1. Promotes hair growth.
2. Improves the scalp health.
3. Strengthens hair.
4. Natural antioxidants.
5. Aromatic benefits.
6. Protects against damage.
7. Add shine and luster.[14]

SHIKAKAI

Taxonomical classification

Kingdom: Plantae
Phylum: Angiosperms
Class: Eudicots
Order: Fabales
Family: Fabaceae(Leguminosae)
Genus: Acacia
Species: Acacia concinna

In the Indian Subcontinent, Shikakai Acacia concinna has long been used as a hair care product. It's one of the therapeutic herbs used in Ayurveda. It has been used as a shampoo historically. To prepare it. The plant's fruit pods, leaves, and bark are dried and pulverized into a powder. This conventional shampoo is nonetheless regarded as a good cleanser even though it doesn't generate the same amount of lather as a shampoo with sulfates. Because of its naturally low pH, it is mild and doesn't remove natural oils from hair. Shikakai also functions as a detangler, so usually, no conditioner is required.[15]

Shikakai, also known as Senegalia rugata, is a spiny, climbing shrub native to China and tropical Asia. The excerpt attained from its capsules is used as a hair cleaner and for the control of dandruff. Shikakai or acacia concinna, has a rich quantum of vitamin C, which is salutary for hair. Shikakai naturally lowers the pH value retains the natural canvases of the hair and keeps it lustrous and healthy. It's also effective in strengthening and conditioning hair. Amla, reetha,and Shikakai suit all hair types and help resolve ends, hair fall, dandruff, greying of hair, andother hair-related problems, to make hair soft and silky.[16]

Applications of shikakai

1. Hair growth.
2. Cleanser.

3. Anti-fungal and Anti-bacterial properties.
4. Heals wounds.
5. Antioxidant.
6. Control hair fall.
7. Used in making detergents.[17]

ONION

Taxonomical classification

Kingdom: Plantae
Phylum: Angiosperms
Class: Monocots
Order: Asparagales
Family: Alliaceae
Genus: Allium
Species: Allium cepa

Commonly referred to as the bulb onion or common onion, the onion (Allium cepa L, from Latin cepa "onion") is the most extensively farmed type of Allium in the genus. Close relatives of this plant include Chinese onions (Allium cepa) and garlic, shallot, leek, and chives. The Liliaceae family of plants is said to have antimicrobial and antibacterial properties as well as superior nutrition. It is also used as a hair scalper to treat hair loss.[18] Onion is known for its medicinal value. It is also used in the cosmetic industry. They reduce hair loss and increase the expansion rate of hair. As a good source of vitamin C, onions may support the building and maintenance of collagen. Collagen provides structure to skin and hair.[19]

Application of onion

1. Onions are rich in sulfur, they turn your grey hair into golden brown by nourishing hair follicles.
2. In addition, this will promote your hair growth too.
3. It has anti-bacterial properties which clear the dirt and bacteria from the scalp.
4. It also helps in controlling dandruff.
5. It acts as a hair toner.[20]

MATERIALS AND METHODOLOGY

MATERIALS

Herbal drug	:	Rosemary Shikakai Onion
Foaming agent	:	Reetha powder
Absorbent and Stabilizer	:	Arrowroot powder
Preservative	:	Neem powder
Conditioning agent	:	Aloe vera powder

FORMULATION

Ingredients	F1	F2	F3
Rosemary	5	10	15
Shikakai	10	15	5
Onion	15	5	10
Reetha	7.5	7.5	7.5
Arrowroot	5.5	5.5	5.5
Aloe vera	6	6	6
Neem	1	1	1

METHODOLOGY

- Drying: All the powders are in dry form and grinded.
- Weighing: All the required herbal powders for dry shampoo powder preparation were weighed individually.
- Size reduction: The crude ingredients were collected and these ingredients were sizereduced using a hand-driven mixer individually.
- Mixing: All these fine ingredients were mixed by a mixer to form a homogenous fine powder.
- Sieving: Then this fine powder was passed through sieve no: 120 to get a sufficientquantity of powder.

EVALUATION STUDIES

1. Visual appearance

Visual appearance parameters like color, texture, and odor were carried out. Color and texture were evaluated by vision and touch sensation respectively.

2. Particle size

Sieving method: Particle size is determined by the sieving method by using IP standard sieves by mechanically shaking for 10 minutes.

3. Angle of repose

It is defined as the maximum angle possible between the surface of pile of the powder to the horizontal flow.
Funnel method: The required quantity of dried powder is taken in a funnel placed at a height of 6cm from a horizontal base plane. The height and radius of the powder were noted and recorded.

The angle of repose (Θ) can be calculated using the formula

$$\theta = \tan^{-1} (h / r)$$

Where, θ – Angle of repose,
h – Height of the heap,
r – Radius of the base

Angle of repose (degrees)	Type of flow
25-30	Excellent
31-35	Good
36-40	Fair
41-45	Passable
46-55	Poor
56-65	Very poor
>66	Very very poor

4. Bulk density

Bulk density is the ratio between the given mass of a powder and its bulk volume. The required amount of the powder is dried and filled in a 50ml measuring cylinder up to the 50ml mark. Then the cylinder is dropped onto a hard wooden surface from a height of 1 inch at a 2-second interval. The volume of the powder is measured. Then the powder is weighed. This is repeated to get the average value. The bulk density is calculated by using the below-given formula below.

Bulk Density= Mass of herbal powder shampoo
Volume of the herbal powder shampoo

5. 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 minute, and volume or mass readings are taken until little further volume or mass change is observed. It was expressed in grams per cubic meter (g/cm3)

$$\text{Tapped Density} = \frac{\text{Weight of powder}}{\text{Tapped volume of powder}}$$

6. Carr's index

The Carr's index also known as Carr's compressibility index is an indication of the compressibility of the powder. Compressibility is a measure of the relative volume change of a fluid or solid as a response to a pressure change or stress. It is named after the pharmacologist Charles Jellef Carr. It measures the relative significance of inter-particle interaction.

Carr's index is calculated using the formula below

$$\text{Compressibility index} = 100 \times \frac{(V0 - Vf)}{V0}$$

Where

V0 = Bulk volume

Vf = Tapped volume

Carr's index	Flow Property
≤10	Excellent
11-15	Good
16-20	Fair
21-25	Passable
26-31	Poor
32-37	Very poor
>38	Very very poor

Physicochemical evaluation

1. Determination of pH

The pH of 10% shampoo powder in distilled water was determined at a room temperature of 25°C. The pH was measured using a digital pH meter.

PROCEDURE

Precleaning

Clean the outer surface with the help of the duster.

Operating procedure:

- Connect the pH electrode and thermal electrode and fix it on the stand.
- Switch on the instrument.
- Record the temperature.
- Select the calibrate mode.
- Remove the electrode from the storage solution. Rinse the electrode with distilled water and make it dry with tissue paper.
- Calibrate the instrument using 4.00, 7.00, and 10.00 – pH buffer.
- Select the measurement mode.
- Read the pH of the solution from the display
- Place the electrode back in the storage solution
- Switch off the instrument.

  Note: Wash and rinse the electrode with distilled water and wipe with tissue paper after every dip in solution.

2. Wetting time

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

3. Foaming index

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

$$\text{Foaming index} = 1000/a$$

4. Foaming capacity

2 grams of each herbal shampoo powder formulation were taken in a 250ml measuring cylinder, and 50ml of water was added and shaken for 5 to 10min. The foaming capacity of the formulation after 1min shaking and foaming capacities of the formulation for 60 minutes were performed.

RESULT AND DISCUSSION

1. VISUAL APPEARANCE

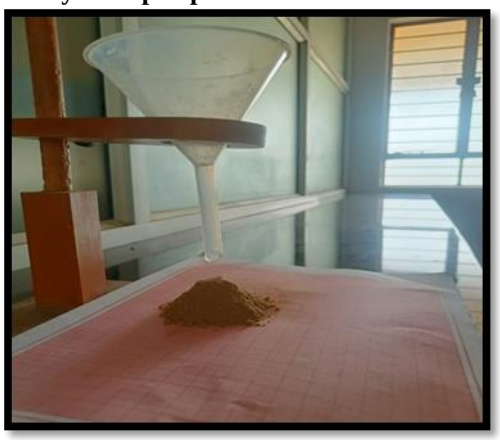
- Color: The color of all three formulations was checked by visual inspection. A brownish color was obtained.
- Odor: The odor of all three formulations was determined by smell.
- Texture: The texture of all three formulations was checked by touch sensation respectively.

2. GENERAL POWDER CHARACTERS

It includes the determination of particle size, angle of repose, bulk density, tapped density, and Carr's index.

SL NO	PARAMETER	EVALUATION
1	Color	Brownish
2	Odor	Characteristic
3	Texture	Fine and smooth

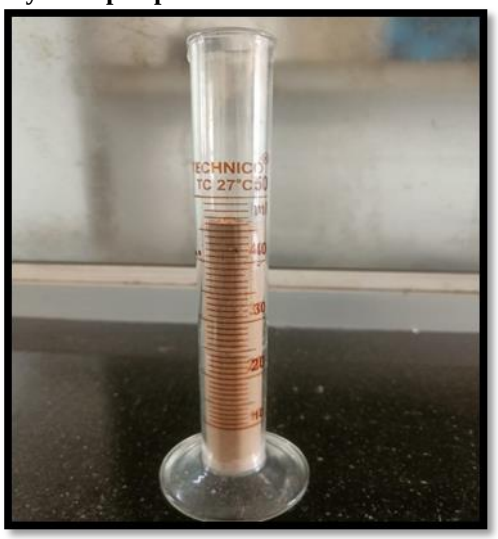
Angle of repose calculation of herbal dry shampoo powder



Formulation	Method	Height of the Cone (hin cm)	Radius of the cone (rin cm)	tanθ =(h/r)	θ= tanˆ1	Flow property
F1	Funnel method	2.2	3.4	32.63	0.6470	Good flow
F2		2.3	3.8	30.98	0.6052	Excellent
F3		2.4	3.1	37.30	00.7741	Fair flow

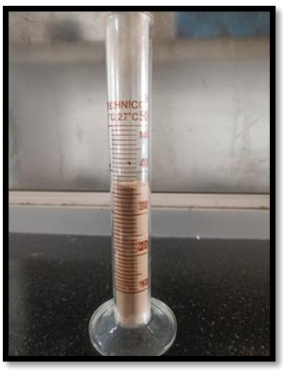
The angle of repose of three formulations was found to be F1=32.63 which has good flow property, F2=30.98 which indicates excellent flow property and F3=37.30 which has fair flow property. In these three formulations, the value of F2 lies between 25-30 which shows excellent flow properties compared to F1 and F3. Hence F2 is considered.

Bulk density calculation of herbal dry shampoo powder



Formulation	Bulk volume(ml)	Mass of the powder (gm)	Bulk density gm/ml
F1	47	18.00	0.3829
F2	46	17.04	0.3704
F3	47	16.9	0.3595

The bulk density of the three formulations was found to be F1=0.3829, F2=0.3704, and F3=0.3595. All three powders pass the limit of bulk density. The bulk density of the powder should be in the range of 0.1-0.7gm/ml.



Tapped density calculation of herbal dry shampoo powder

Formulation	Tapped volume	Mass of thepowder	Tapped density(gm/ml)
F1	50	18.00	0.36
F2	50	17.04	0.3408
F3	50	16.9	0.338

The tapped density of the formulations was found to be F1=0.36, F2=0.3408 and F3=0.3. All three powders pass the limit of tapped density. The tapped density of the powder should be in the range of 0.1-0.7gm/ml.

Carr's index calculation of herbal dry shampoo powder

Formulation	Tapped density	Bulk density	Carr'sindex
F1	0.36	0.3829	6.36
F2	0.3408	0.3704	8.685
F3	0.338	0.3595	6.36

The car's index of three formulations was found to be F1=6.36 F2=8.685 and F3=6.36. Where the three formulations show excellent flow properties since they lie in the range of 5-15.

- The particle size of the powder was found to be 20-25um, angle of repose is 30"9

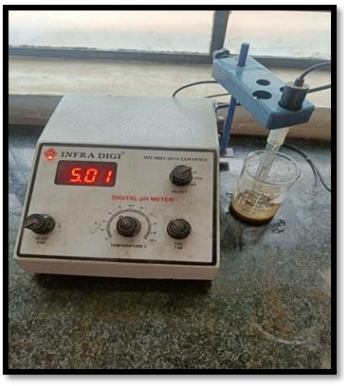
Bulk density is 0.37gm/ml and tapped density was found to be 0.34gm/ml

And Carr's index is 8.68

SL NO	PARAMETER	EVALUATION
1	Particle Size	20- 25um
2	Angle of repose	30"9
3	Bulk density	0.37
4	Tapped density	0.34
5	Carr's index	8.68

3. PHYSICOCHEMICAL EVALUATION

DETERMINATION OF PH



Standard pH	Obtained pH		
	F1	F2	F3
5.0 to 7.0	5.13	5.01	5.34

The pH test of dry shampoo powder was measured by using the calibrated pH meter and the pH of the three formulations was found to be F1=5.13, F2=5.01, and F3=5.34. F2 is closer to the standard value so F2 formulation was considered.

WETTING TIME

EVALUATION PARAMETER	F1	F2	F3
Wetting time	2 min 15 sec	2 min 0 sec	2 min 40 sec

The wetting time of three formulations was found to be F1=2min 15sec, F2=2min 0sec and F3=2min 40sec. The wetting time of F2 was considered because it took less time to sink the disc than that of F1 and F3.

FOAMING INDEX

F1

Sl no	1	2	3	4	5	6	7	8	9	10
Stock solution (ml)	1	2	3	4	5	6	7	8	9	10
water	9	8	7	6	5	4	3	2	1	0

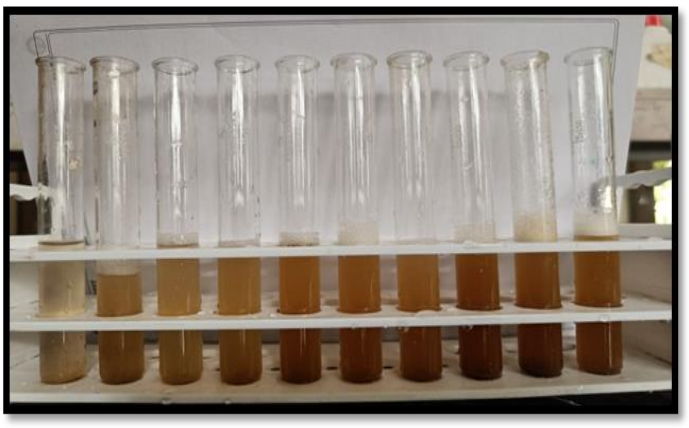
T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
0.5	0.2	0.6	0.7	0.8	0.5	0.9	0.7	0.6	0.8

The foam produced was not more than 1cm, So F1 was not considered.

F2

Sl no	1	2	3	4	5	6	7	8	9	19
Stock solution(ml)	1	2	3	4	5	6	7	8	9	10
water	9	8	7	6	5	4	3	2	1	0

T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
0.7	0.5	0.8	0.9	0.7	0.8	0.9	0.6	1	0.8



The foam produced was more than 1cm in the test tube number 9. The foaming index was calculated for it.
Foaming index= 1000/a = 1000/9=111.1 %.

The foaming index of the formulation was found to be 111.1%

F3

Sl no	1	2	3	4	5	6	7	8	9	10
Stock solution(ml)	1	2	3	4	5	6	7	8	9	10
Water	9	8	7	6	5	4	3	2	1	0

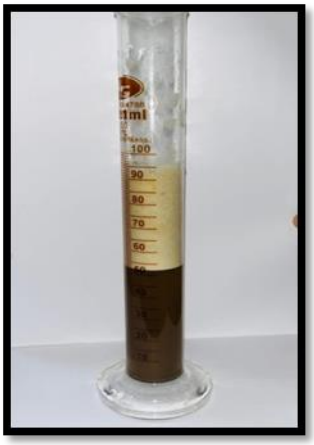
T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
0.7	0.6	0.8	0.9	0.7	0.6	0.7	0.5	0.8	0.9

The foam produced was not more than 1cm, So F3 was not considered.

Here the test tubes contain stock solution and water, shaken for 15sec and allowed to stand for 15min. F1 and F3 formulations produced foam of less than 1cm and F2 produced foam of 1cm which is taken into consideration.

FOAMING CAPACITY

EVALUATION PARAMETER	F1	F2	F3
Foaming capacity	Mild foam	Good foam	Mild foam



The foaming capacity of three formulations was visually observed by measuring the height of the foam produced. F1 formulation produced mild foam and F2 has produced good foam and F3 has produced mild foam. F2 which produced good foam is taken into consideration.

CONCLUSION

In conclusion, the research on dry shampoo powder formulated with rosemary, shikakai, and onion demonstrates significant potential as a natural and effective alternative to conventional shampoos.Rosemary offers antimicrobial and antioxidant properties, promoting scalp health and stimulating hair growth. Shikakai serves as a natural cleanser and conditioner, gently cleansing the scalp without stripping it of essential oils. Onion, rich in sulfur, enhances hair strength, reduces breakage, and may stimulate hair follicles. The combination of these ingredients provides a holistic approach to hair care, addressing concerns like dandruff, hair thinning, and scalp irritation. Moreover, the absence of harsh chemicals in this formulation aligns with the growing demand forsustainable and organic personal care products. Further studies can explore the long-term benefits of this dry shampoo, its effects on various hair types, and its market viability to offer an innovative,eco-friendly solution to hair care.

In this study, three formulations were prepared F1, F2, and F3 respectively. The bulk density of F1 formulation is 0.3829gm/ml, F2 formulation is 0.3704 and F3 is 0.355 where all three formulations pass the specification. The tapped density of formulation F1 is the pH of F1 formulation is 5.13 and F2 is 5.01 and F3 is 5.34. The car's index of three formulations was found to be F1 is 6.36 and F2 is 8.685 and F3 is 6.36. All three formulations show excellent flow properties since they lie in the range of 5-15. In which F2 was considered because the pH of the F2 formulation was 5.01 which was close to the standard pH of shampoo. Since it is closer to standard PH shows effective results. The angle of repose of F2 formulation is 30.98 which indicates excellent flow property, F1 formulation shows good flow property and F3 shows fair flow property. The wetting time of F2 formulation was found to be 2min which is lesser than that of the other two formulations F1 which is 2mins 5sec and F3 is 2min 40sec. In the foaming index, only F2 formulation showed foam of 1cm length even after a resting time 30min also good foam was produced.

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