

**FORMULATION, EVALUATION & COMPARISON OF HERBAL SHAMPOO
CONTAINING TRICHOSANTHES CUCUMERINA**Pasam Jyothirmayi*¹, R. Triveni², M. Swapna², Vasundhara², Ch. Alekha² and Abbineni Anusha²¹Department of Pharmacy, Krishna University, Krishna District, Andhra Pradesh, India.²Department of Pharmaceutics, Vikas College of Pharmacy, Vissannapeta, Krishna District, Andhra Pradesh, India.***Corresponding Author: Pasam Jyothirmayi**

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ABSTRACT

Aim and Objective: The aim of this present study is to formulate and evaluate herbal shampoo containing *Trichosanthes cucumerina*, to eliminate harmful synthetic ingredients, and substitute with safe natural ingredients which improve the safety and efficacy. **Methods:** Three different formulations of shampoos using the extract of *Trichosanthes cucumerina* were prepared. Among them HS1 is soap based, HS2 is gel shampoo and HS3 is totally herbal based with *Trichosanthes cucumerina* as main herbal component along with *Phyllanthus emblica*, *Hibiscus rosa-sinensis*, *Sapindus indica* and *Azadiraktha indica* in different proportions. Evaluation of organoleptic, physicochemical, and performance tests in terms of visual assessment, wetting time test, pH, assurance of solid contents, surface tension, detergency, dirt dispersion, conditioning performance, foam volume, and stability was performed. **Results:** The formulated shampoos were clear and good appealing. It demonstrated good froth stability, detergency, good cleansing, small bubble size, low surface strain, and execution of good conditioning. **Conclusion:** The physicochemical evaluation of the formulated shampoo showed ideal results. However, to improve its quality, product performance, and safety, further development was required.

KEYWORDS: Herbal shampoo, *Trichosanthes cucumerina*, Alopecia and Hair growth.**INTRODUCTION**

Hair is a product of differentiated organs in the skin of mammals. It differs in individual only in colour, quantity and texture. Hair is primarily protein (65 to 95 %, keratin essentially), together with water (15 to 35 %) and lipids (1 to 9 %). The mineral content of hair ranges from 0.25 to 0.95 %.^[1,2] Alopecia is generally recognized as the most common hair loss cause and may be responsible for over 95 % of pattern hair loss for both men and women. *Trichosanthes cucumerina* (family- cucurbitaceae) is known as snake guard is a monoecious annual climbing herb with tendrils. The aqueous extract of *Trichosanthes cucumerina* is having growth promoting activity comparative with that of 2% Minoxidil.^[3,4] The real technology of cleaning the hair and scalp was developed by the introduction of cake soap which was followed by the production of shampoo products. Shampoos are the viscous solution of detergents containing suitable additives preservatives and active ingredients.^[5] It is usually applied on wet hair, massaging into the hair, and cleansed by rinsing with water. The purpose of using shampoo is to remove dirt that is build up on the hair without stripping out much of the sebum.^[6] Nowadays natural products dominate over the synthetic products since it has no side effects. This is one reason that the

herbal products are popular among the consumers. Synthetic hair products have chemicals which may give short term growth and shine to hair, but definitely when used for long term damages the hair which may even lead to baldness, premature hair graying and hair loss.^[7]

MATERIALS AND METHODS

Trichosanthes cucumerina, *Phyllanthus emblica*(*amla*), *Hibiscus rosa-sinensis* (*Hibiscus*), *Sapindus indica* (*soapnut*) *Azadiraktha indica* were obtained from the natural resources which were air dried, powdered and aqueous extracts were prepared. All other excipients are of suitable analytical grade.

Preparation of plant extracts (*Trichosanthes cucumerina*)

All the collected plant Materials were shade dried and powdered. From these powders approximately 250g of powder was weighed and defatted with petroleum ether and further they were extracted with water to obtain aqueous extract. It was then concentrated at 40°C under reduced pressure in a rotary vacuum evaporator. This concentrated extract was then subjected to preliminary phytochemical screening.^[8]

Preparation of shampoo**Table 1: Composition of Soap based shampoo (HS1).**

Coconut oil	10.0 ml
Trichosanthes cucumerina extract	2.5g
Potassium hydroxide 85%	5.38 g
Sodium hydroxide 93%	0.5 g
Glycerine	13 ml
Oleic acid	14 ml
Water	56.7 ml
Perfume	0.4 ml

Dissolve potassium hydroxide in 1/3 of the water Heat the coconut oil on water bath and add the alkali solution in a thin steam with continuous stirring until saponified. Allow the coconut soap to become cold stand over night. Mix glycerine with half of the remaining water and bring it boil then add coconut soap in small portions and stir until it dissolves. Dissolve the sodium hydroxide in the

test of the water and add to the soap solution immediately after the coconut soap has dissolved add the oleic acid and stir slowly until completely saponified and perfume.^[9] Keep the product for few days chill to 32°F and then filter it. Fill the product in an appropriate bottle and label properly.

Table 2: Composition of Solid cream / gel shampoo (HS2).

Sodium lauryl sulphate paste	47.0 g
Trichosanthes cucumerina extract	2.5g
Oleic acid	20 g
Triethanolamine	10.5 g
Water	22.5 ml
Perfume	Q S
Preservative	Q S

Mix water oleic acid and sodium lauryl sulphate paste and heat to 60°C. Slowly add triethanolamine with continuous stirring and perfume after Cooling to 35°C.^[10]

- Determination of solid content percentage
- Surface tension measurement
- Testing of wetting
- Foam stability test
- Dirt dispersion test
- Cleaning action

Table 3: Composition of Herbal shampoo (HS3).

10% gelatine solution	q.s
Citric acid	1 ml
Trichosanthes cucumerina extract	2.5g
Amla extract	2.5 g
Neem extract	2.5 g
Hibiscus extract	2.5 g
Soap nut extract	2.5 g
Methyl paraben	1 ml
Lemon juice	1ml

The plant extract were mixed in different proportions to obtain a shampoos whose formula is shown in table 3. Herbal extracts were added to 10% gelatine solution and were mixed by shaking for 20 minutes lemon juice 1 ml and methyl paraben were also added with stirring. Finally the pH of the solution was adjusted by adding sufficient quantity of 1% citric acid solution. Few drops of rose essential oil were also added to impart aroma to the prepared shampoo and the final volume was made to 100ml with gelatine solution.^[11]

Evaluation

The following studies were performed for prepared shampoos

- Visual assessment
- pH determination

Evaluation of shampoo: The prepared formulation was evaluated for product performance which includes organoleptic characters, pH, physicochemical characterization, and for solid content. To guarantee the nature of the items, particular tests were performed for surface tension, foam volume, foam stability, and wetting time using standard protocol.^[12]

Visual assessment

The prepared formulation was assessed for color, clarity, odor, and froth content.

pH determination

The pH of the prepared herbal shampoo in distilled water (10% v/v) was evaluated by means of pH analyzer at room temperature.^[13]

Determination of solid content percentage

The percentage of solid substance was determined by weighing about 4 g of shampoo in a dry, clean, and evaporating dish. To confirm the result, the procedure was repeated again. The liquid portion of the shampoo was evaporated in a dish by placing on hot plate. The

percentage and the weight of the solid contents present in the shampoo were calculated after drying completely

Surface tension measurement^[14]

The surface tension of 10% V/V shampoo was determined by using stalagmometer using chromic acid and purified water. Because surface tension is highly affected with grease or other lubricants. The data calculated by the following equation given below:

$$R3 = (W3-W1) n1 \times r1 / (W2-W1) n2$$

Where,

W1 is weight of empty beaker.

W2 is the weight of beaker with distilled water.

W3 is Weight of beaker with shampoo solution.

N1 is no. Of drops of distilled water.

N2 is no. Of drops of shampoo solution.

R1 is the surface tension of distilled water at room temperature.

R2 is surface tension of shampoo solution.

Testing of wetting

Wetting time was calculated by noting the time required by the canvas paper to sink completely.^[3] A canvas paper weighing 0.44 g was cut into a disc of diameter measuring 1-inch. Over the shampoo (1% v/v) surface, the canvas paper disc was kept and the time taken for the paper to sink was measured using the stopwatch.^[15]

Foam stability test

The stability of the foam was determined using cylinder shake method. About 50 ml of formulated shampoo (1%) solution was taken in a graduated cylinder of 250 ml capacity and shaken for 10 times vigorously. Foam stability was measured by recording the foam volume of shake test after 1 min and 4 min, respectively. The total foam volume was measured after 1 min of shaking.

Dirt dispersion test

To 10 ml of refined water two drops of cleanser were included and taken in a wide-mouthed test tube. To the formulated shampoo, added one drop of Indian ink and shaken for 10 min after closing the test tube with a stopper. The volume of ink in the froth was measured and the result was graded in terms of none, slight, medium, or heavy.⁵⁹

Cleaning action 5 grams of wool yarn were placed in grease, (W₁) after that it was placed in 200 ml. of water containing 1 gram of HS in a flask. Temperature of water

was maintained at 35⁰ C. The flask was shaken for 4 minutes at the rate of 50 times a minute. The solution was removed and sample was taken out, dried and weighed (W₂). The amount of grease removed was calculated⁶⁰ by using the following equation.

$$DP = 100(1 - W_2/W_1)$$

In which, DP is the percentage of detergency power

According to Bureau of Indian Standards the ideal properties a shampoo must possessed are mentioned below. The shampoo formulation was evaluated for the ideal properties.^[61,62]

- a) **Ease of application:** The shampoo formulation was observed visually and keeping it on the hand to evaluate that the shampoo should be viscous enough to stay in the hands before application to the hair and scalp and during application, the shampoo must spread easily and disperse quickly over the head and hair.
- b) **Rinsing:** The hair were washed with water and it was observed that the shampoo should rinse out easily and should not leave a residual tackiness or stickiness and should not form a dulling film on the hair.
- c) **Easy wet combing:** After washing the hair they were dried with clean and dry cotton towel and subjected to combing with regular nylon comb. Ideally the hair should comb through easily without tangling.
- d) **Manageability:** The hairs were combed after they get dried to observe that the hair should be left in a manageable condition when combed dry. There should not be fly away or frizziness.
- e) **Luster:** The hairs were observed for having luster, as ideal shampoo should impart luster to the hair.
- f) **Body:** The hair should have body when dried. That is hair should not limp or over conditioned. The hairs were observed for having body after getting dried.
- g) **Fragrance:** The shampoo was observed that it should not contain any objectionable odor and should leave fresh refreshing scent on the hair. This could be the major factor in consumer acceptance of the product.^[63]
- h) **Economical:** While making formulation the stress was given to this specification to make the product as simple as possible. Shampoo formulation was developed using only those raw materials that were necessary to accomplish the desired goal.

Reports

Table 4: Physico chemical evaluation of shampoo formulations.

Parameter	HS1	HS2	HS3
color	Brown	Brown	Green
Transparency	Opaque	Clear	Clear
odor	Good	Good	Good
pH (10% solution)	7.0	6.8	6.8
Foaming ability	Yes	Yes	Yes

% solid contents	20	22	25
Foam volume	85ml	80ml	75ml
Foam type	Small, uniform	Medium, uniform	Medium, uniform
Foam stability	Good	Good	Good
Surface tension (dynes/cm)	33.12	32.26	33.64
Dirt dispersion (ink in foam)	light	light	light
Wetting time (sec)	12	13	12
Cleaning action DP=100(1-T/C)%	12.26	11.64	12.68

Table 5: Foaming stability of herbal shampoo formulations respected to time.

S. No.	Time	Height of foam (cm)		
		HS1	HS2	HS3
1	0	178	175	175
2	1	176	173	173
3	2	174	171	170
4	3	172	169	168
5	4	168	162	160
6	5	164	158	156
7	10	156	152	150
8	20	147	144	142
9	30	138	136	136

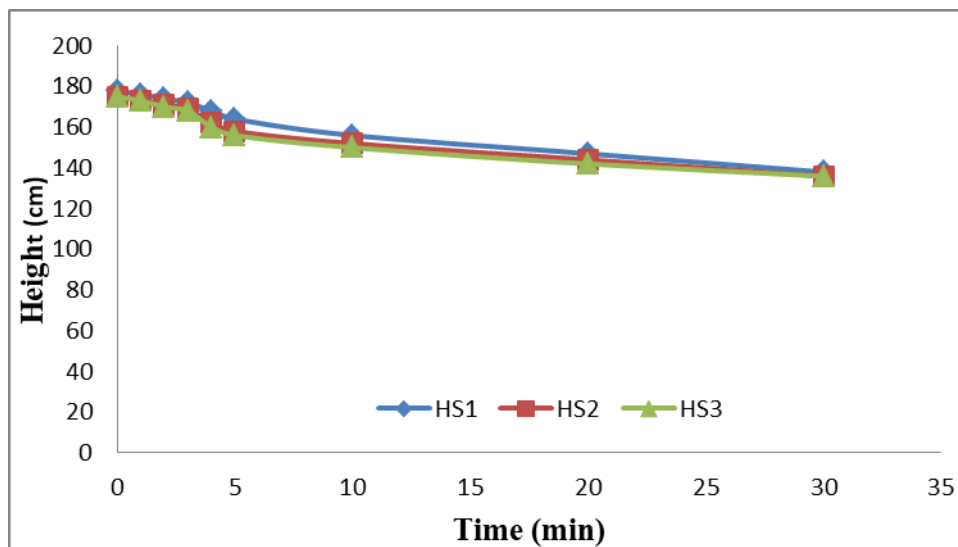


Fig 1: Foaming stability of herbal shampoo formulations respected to time

Table 6: Other evaluation Parameters.

Parameter	HS1	HS2	HS3
Ease of distribution	+++	+++	+++
Ease of rinsing	+++	+++	++
Ease of combing (wet)	++	++	++
Ease of combing (dry)	+++	+++	+++
Nature of hair after wash	Soft and manageable	Soft and manageable	Soft and manageable
Speed of drying	11 min	12 min	9 min

RESULTS AND DISCUSSION

Results

Shampoo formulation

In this work three different formulations were prepared. Among them HS1 is soap based, HS2 is gel shampoo and HS3 is totally herbal based shampoo with gelatin base. The primary surfactant is the key component in shampoos responsible for foam and cleansing such as

SOAP formation in HS1 and sodium lauryl sulphate in HS2. Herbal shampoo HS3 was formulated by admixing the equal amount of the aqueous extracts of all the ingredients with soapnut (Table 1). The above plant extract contains phytoconstituents like saponins which is a natural surfactant having detergent property and foaming property. An ideal shampoo must have adequate viscosity and many natural substances possess good

viscosity. The gelatin solution (10%) behaves as a pseudoplastic forming clear solutions. Lemon juice (1 ml) added to the shampoo serves as anti-dandruff agent, natural antioxidant, and chelating agent and maintains the acidic pH in the formulation.

Evaluation of formulated shampoo

Physical appearance

The prepared all shampoo formulations showed good characteristics in terms of foaming effect and appearance on the visual inspection of the formulation. The results are shown in Table 2.

pH

The pH of the prepared solution of shampoos using distilled water (10%) were evaluated at 25°C temperature. For enhancing and improving the hair quality, pH of the shampoo is very important and also for stabilizing the scalp and minimizing irritation to the eyes.^[16] For minimizing the damage of hair using shampoo, one of the ways in the present trend is to develop shampoos having lower pH value. Lowering of pH (mild acidity) promotes tightening of the scales and prevents swelling, thereby producing sheen. The results are presented in Table 2.

Solid content

Shampoo with high solid content will be very difficult to rinse and hard to work with the hair. The prepared Herbal shampoo contains 25% of solid content. Thus, they considered easy to wash out when having less solid content during preparation of shampoos (Table 2).

Surface tension

The surface tension reduction in the prepared shampoo was found to be of about 33.4 dynes/cm (Table 3). One of the mechanisms in the detergency property is the lowering of surface tension, and this will be the marker for a good detergency effect of the shampoo which could be done by reducing the surface tension of water from 72.8 dynes/cm to the surface tension of water 32–37 dynes/cm.

Wetting time

To test the efficacy of the shampoo, wetting ability of a surfactant needs to be calculated which depends on the concentration of surfactant.^[17] For the evaluation of wetting ability of the shampoo, canvas disc method is used which is an efficient, quick, easy, and reliable method. The prepared shampoo shows the wetting time of the about 120 s. The maximum of wetting time shows that the shampoo contains lower amount of detergents.

Foaming ability and foaming stability

From the consumer point of view, foam stability is one of the important needs of a shampoo. Important parameter that was considered in the shampoo evaluation was determination of foaming stability. The foam volume produced by the formulated shampoo is above 50 ml. The prepared shampoo generates uniform, medium

sized, compact, denser, and stable foam. The foam volume remains same throughout the period of about 5 min showing that the generated foam by the shampoo has good stability and the prepared shampoo exhibits higher foam property which may be due to the presence of both shikakai and soapnut.^[17]

Dirt dispersion test

In the dirt dispersion test using Indian ink, the volume of ink in the froth was measured and the result was graded as none, light, moderate, or heavy.

Conditioning performance

Based on the conditioning performance of the prepared shampoo, the results revealed that the shampoos formulated were having good conditioning effect.

In the case ease of combing (dry) all the three formulations showed better result without friction whereas other formulations showed combing with friction. The nature of hair after wash is the texture of hair and after the washing process. For a shampoo to be of good quality the hair after wash should be soft and manageable. This study clearly shows that the herbal shampoo is soft and manageable.

CONCLUSION

A shampoo may be described as a cosmetic preparation meant for washing hair and scalp, packed in a form convenient for use. Its primary function is of cleansing the hair of accumulated sebum, scalp debris and residues of hair grooming preparations. The added functions of shampoo include lubrication, conditioning, bodybuilding, prevention of static charge build up, medication and so on. Finally, the complete shampoo formulation must be medically safe for long-term usage.

This study was aimed at preparing stable formulations of shampoos rich with *Trichosanthes cucumerina* extract that contains low surfactants to reduce the risk of chemicals. Different shampoo formulations HS1, HS2 and HS3 were prepared. All the formulated shampoos were found to possess all the ideal properties that any good shampoo must possess. Among them HS3 is totally herbal based consisting of *Trichosanthes cucumerina* as main constituent to promote hair growth (especially in case of Alopecia), Some of the plants which possess antidandruff property are Citrus limon, *Sapindus indica*, flowers of *Hibiscus* repairs dull and dry hair along with antidandruff activity, Amla improves the blood circulation and strengthens the hair follicles etc. were also included in formulaion HS3.

The formulated shampoo was found to possess all the ideal properties that any good shampoo must possess. The shampoo was viscous enough to stay in the hand before application to the hair and scalp, yet during application the shampoo spreaded easily and dispersed quickly over the head and hair. The shampoo developed a dense and luxurious lather. The shampoo was found to

remove dust, soil, and sebum from the hair. It was rinsed out easily and did not leave a residual tackiness and stickiness. After rinsing, the hair combed through easily without tangling. There was no flyaway or frizziness observed in hair when combed dry. The hair were left in a lustrous condition, did not limp or over conditioned and shampoo left a clean. Stability studies showed a stable homogenous appearance during three months of storage at different temperatures (4-8°C, 40°C and at ambient temperature). Further research is required to improve its quality especially on the conditioning performance. Finally, the complete shampoo formulation must be medically safe for long-term usage, it is not only equivalent in its performance to the synthetic ones but also have better safety, efficacy and purity.

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