

(RESEARCH ARTICLE)



Formulation and evaluation of herbal shampoo

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Abstract

Background: Now-a-days many synthetic, herbal, medicated and non - medicated shampoos are available in the market but popularity of herbal shampoo among consumers is on rise because of their belief that these products being of natural origin are safe and free from side effects.

Aim: The present study is aimed to formulate and evaluate the polyherbal shampoo in comparison with commercial shampoo.

Preparation of herbal shampoo: To formulate a clear shampoo base, three samples, designated as F1, F2 and F3 were prepared by using *Solanum Pubescens* leaves, *Achyranthus aspera* roots as main ingredients.

Results: The formulation F3 and dove have good foaming ability. No significant difference was observed in terms of odor and foaming ability between F3 Dove. The p^H of F1, F2 and F3 was found to be 5.0, 5.4, and 6.2. The percent solid contents of F1, F2 and F3 and dove was found within the range of 22 to 25%. Viscosity of F1, F2 and F3 and dove was found to be 60, 61, 65 and 67 cps. F1, F2 and F3 and Dove showed similar reduction in surface tension ranging from 31.00 to 39.00 dyn/cm. The wetting time of F1, F2 and F3 and dove was found to be 195, 190, 178, 170 seconds. The F3 and Dove was shown foam volume as 85, 90, 98 and 110ml. Accelerated stability tests showed that no significant change over a period of time (3 months) for F3.

Conclusion: In conclusion, the results showed that F3 had no significant difference in comparison to reference shampoo regarding their physicochemical properties and their *In vitro* evaluation.

Keywords: Herbal shampoo; Physicochemical properties; *In vitro* evaluation

1 Introduction

Hair is one of the vital parts of the body derived from ectoderm of the skin and is protective appendages on the body and considered accessory structure of the integument along with sebaceous glands, sweat glands and nails. They are also known as epidermal derivatives as they originate from the epidermis during embryological development. Hair is an important part of the overall appeal of the human body. Hair is one of the external barometers of internal body conditions. Shampoos are probably the most widely used cosmetic products for cleansing hairs and scalp in our daily life¹.

A shampoo may be defined as a preparation of a surfactant (i. e. Surface active material) in a suitable form-liquid, solid, or powder which when used under the conditions specified will remove surface grease, dirt and skin debris from the hair, shaft and scalp without affecting adversely the hair, scalp or the health of the user. Today, a plethora of shampoos

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are available for men and women. A good shampoo should almost immediately form abundant foam irrespective of the type of water used or the nature of soil or fat to be removed from hair. Though foam formation is not released to the cleansing effect, but people psychologically always prefer a high foam product. Some good shampoos are found to have side effects like drying effect on the hair. This leaves the hair too dry to handle or comb. So proper conditioning of the hair is also an important consideration, some shampoos cause irritation to the eye and a lasting corneal cloud. These should be avoided. The functions of shampoo are expected to be various. A good and acceptable shampoo should have the following characteristics. Composition of Shampoos 2-6 the following are the ingredients used for preparation of shampoos. They include Primary surfactants eg. Sodium lauryl sulphate, triethanol lauryl sulphate. Secondary surfactants eg. dialkyl sulpho succinates, monoalkyl sulpho succinates. Germicides and Antidandruff agent's eg. salicylic acid, Benzoic acid. Conditioning agents eg. Fatty substances like lanolin, oils. Pearlescent agent's eg. 4-methyl-7-diethylamino coumarin. Sequestrates eg. Sodium salt of EDTA. Thickening agents eg. Alginates. Preservatives eg. formaldehyde, methyl paraben, propyl paraben. Solubilizing agent's eg. aliphatic alcohols, Urea² etc. Now-a-days many synthetic, herbal, medicated and non - medicated shampoos are available in the market but popularity of herbal shampoo among consumers is on rise because of their belief that these products being of natural origin are safe and free from side effects. The present study is aimed to formulate and evaluate the polyherbal shampoo in comparison with commercial shampoo

2 Material and methods

2.1 Collection of Plant materials

- Leaves of *Solanum pubescens* were obtained from Puttaparthi garden and authenticated by Pro. B. Ravi prasad rao, Professor of Botany, S. K. University, Anantapuramu-515003(A. P).
- Roots of *Achyranthes aspera*. L were obtained from surrounding of RIPER authenticated by Pro. B. Ravi prasad rao, Professor of Botany, S. K. University, Anantapuramu-515003(A. P).
- Reetha, Sheekakai, Amla, Neem powders were obtained from Anantapuramu local market.

2.2 Chemicals

Ethanol, Chloroform, PEG, Carbopol, Xanthan gum, HPMC, 0.1N NaOH, Sodium benzoate, and Distilled water.

2.3 Extraction Procedure

- The collected leaves of *Solanum pubescens* and roots of *Achyranthus aspera* were cleaned from unwanted foreign materials and accurately weighed. Then samples were homogenized and extracted using 5 litres of distilled water by the method of maceration for 72hrs. The extracts were filtered and concentrated to dryness under reduced pressure and controlled temperature (50-55°C) to obtain solvent free semisolid extracts.
- Powders of Sheekakai, Amla and Neem extracted using 5 litres of distilled water by the method of maceration for 72hrs. The extracts were filtered and concentrated to dryness under reduced pressure and controlled temperature (50-55°C) to obtain solvent free semisolid extracts.
- Powder of Reetha extracted using 70% of ethanol, 30% distilled water (700ml ethanol and 300ml of distilled water) and kept for maceration for 72hrs. The extracts were filtered and concentrated to dryness under reduced pressure and controlled temperature (50-55°C) to obtain solvent free semisolid extracts.

2.4 Preparation of herbal shampoo

Table 1 To formulate a clear shampoo base, three samples, designated as F-1, F-2 and F-3 were prepared as below mentioned

Ingredients	Part used	Formulation 1	Formulation 2	Formulation 3
<i>Solanum Pubescens</i>	Leaves	10 ml	10 ml	10 ml
<i>Achyranthus Aspera</i>	Roots	10 ml	10 ml	10 ml
Neem	Leaves	5ml	5ml	5ml
Amla	Seeds	2.5ml	2.5ml	2.5ml
Reetha	Pericarp	10 ml	10 ml	10 ml
Shikakai	Fruit	5ml	5ml	5ml

Lemon Juice	---	5ml	5ml	5ml
Xanthan gum	---	2.5ml	2.5ml	2.5ml
Gelatin	---	2.5ml	---	----
Carbopol	---	2.5ml	2.5ml	5ml
PEG	----	---	2.5ml	5ml

3 Evaluation of herbal shampoos

To evaluate the prepared formulations, quality control tests including organoleptic and physicochemical characterization such as pH, solid contents and viscosity were performed. As well to ensure the quality of the products, specific tests for shampoo formulations including: surface tension, foam volume and foam stability, detergency, eye irritation, skin sensitization tests and preliminary stability study were also carried out. The results were compared with frequently used marketed herbal shampoo³

3.1 Physical appearance/visual inspection

All samples were observed for their physical appearance/visual inspection. The prepared formulations were evaluated in terms of their clarity, odor and foam producing ability^{4,5}

3.2 Determination of pH

The pH of shampoo solution (10% w/v) in distilled water was determined at room temperature. The pH was measured by pH meter⁶

3.3 Percentage of solid contents

Four grams of the prepared shampoo were placed in a clean dry evaporating dish. The weight of the dish and shampoo was determined. The liquid portion of the shampoo was evaporated by placing on a hot plate. Then the weight of the shampoo solid contents after complete drying was determined.^{7,8}

3.4 Surface tension measurement

The surface tension measurement of the diluted shampoos (10% w/v in distilled water) was carried out at 20 °C using du Nuoy tensiometer.⁹

3.5 Wetting time

The canvas was cut into 1-inch diameter discs having an average weight of 0.44 g. The disc was floated on the surface of shampoo solution 1% w/v and the stopwatch started. The time required for the disc to begin to sink was measured accurately and noted as the wetting time.^{10,11}

3.6 Rheological property

The viscosity of the prepared formulations was measured at room temperature using a programmable rheometer (Brookfield DV-III Ultra, Brookfield Engineering Laboratories Inc., USA) fitted with a spindle type S 17 while set at different spindle speeds. The best approach is to take multipoint measurements approximate to those of the process being modeled. All measurements were performed in triplicate at room temperature and the viscosity profile of the shampoos was measured.¹²

3.7 Foaming ability evaluation

Foaming ability was determined using Ross–Miles method: 150 ml of licorice shampoo was poured on 25 ml of aforementioned prepared shampoo in a graduated cylinder from a height of 90 cm, and then the volume of created soap was measured.¹³

3.8 Statistical analysis

The results were given as mean± S. D. (n=3). One-way analysis of variance (ANOVA) comparison test was used to compare characteristics of different formulations with the commercial product. A p value of 0.05 was considered to be significant.

4 Results

Table 2 Physical appearance of the prepared *Solanum pubescens* and *Achyranthus aspera* shampoo formulations

Formulations	Physical appearance	Odor	Foam producing ability
F1	Light Green	Good	Mild foaming
F2	Light Green	Good	Mild foaming
F3	Light Green	Good	Good foaming
Dove	White	Good	Good foaming

Table 3 *In Vitro* Evaluation of the Prepared *Solanum pubescens* and *Achyranthus aspera* shampoo formulations

Formulations	pH	Solid contents (%)	Viscosity (cps) at 10 rpm	Surface tension (dynes cm ⁻¹)	Wetting time (Sec)
F1	5.0±0.1*	22±0.01*	60±0.3*	39±0.05*	195±0.02*
F2	5.4±0.3*	23±0.03*	61±0.4*	35±0.04*	190±0.07*
F3	6.2±0.5*	25±0.05*	65±0.6*	34±0.02*	180±0.05*
(Dove)	6.0±0.4	25±0.04	67±0.8	31±0.01*	170±0.01

Results are mean ± SD (n = 3); *significant difference p < 0.05) by ANOVA single factor

Table 4 Foam volume of Shampoo formulations

Formulations	Foam volume (ml)		
	Distilled Water	Hard Water	Distilled water + Soil
F1	80ml	75ml	65
F2	81ml	78ml	70ml
F3	85ml	70ml	90ml
Dove	98ml	91ml	110ml

Table 5 Stability study of the Prepared *Solanum pubescens* and *Achyranthus aspera* shampoo formulation (F3)

Parameters	1 month	2 month	3month
Physical appearance	Light Green	Light Green	Light Green
Odor	Good	Good	Good
Foam producing ability	Good foaming	Good foaming	Good foaming
pH	6.0±0.5	6.7±0.7	6.9±0.9
Solid contents (%)	27±0.03	28±0.04	30±0.07
Viscosity(cps)	67±0.3	65.6±0.7	63.2±0.4
Surface tension(dynes cm ⁻¹)	34±0.02	36±0.05	38±0.07
Foam Volume (ml)	88	85	80

5 Discussion

Natural cosmetics are popular one all over the world as they convey the impression of having better purity, safety, and efficacy.⁴⁰ The herbal shampoo is important, as people nowadays prefer herbal products than chemical ones for they proved to enhance health. The awareness and need for cosmetics with herbs are on the rise, primarily because it is believed that these products are safe and free from side effects. In the present research work total 3 formulations (table 1) were made and evaluated for different parameters.

5.1 Physical appearance

A shampoo like any other cosmetic preparation should have good appealing physical appearance. The formulated shampoo F1, F2 and F3 was light green and good odor. The commercial shampoo was white and good odor. The foaming ability of F1 and F2 formulations was mild foaming where as F3 and reference shampoo have good foaming ability. No significant difference was observed in terms of odor and foaming ability between F3 and marketed shampoo (Table 2)

5.2 PH

Most shampoos are formulated as either neutral or slightly alkaline to minimize the damage to hair. The pH of shampoo also helps in minimizing irritation to the eyes, enhances the qualities of hair and maintains the ecological balance of the scalp. The pH of tested commercial shampoos was found within the preferred range (between 7 and 5). The pH of F1, F2 and F3 was found to be 5.0, 5.4, and 6.2 respectively. The pH of dove is 6.0 (Table 3)

5.3 Solid contents (%)

Good shampoos usually have 20%, 30% solid content as it is easy to be applied and rinse out from the hair. If it doesn't have enough solid it will be too watery and wash away quickly, similarly too many solids will be hard to work into the hair or too hard to wash out. The percent solid contents of all the formulations and reference was found within the range of 22 to 25% (Table 3)

5.4 Viscosity

The results of rheological evaluation showed that at 10 rpm the viscosity of F1, F2 and F3 and reference shampoos was found to be 60, 61, 65 and 67 cps respectively. These formulations showed pseudo plastic behavior which is a desirable attribute in shampoos formulation. At low rpm the herbal shampoos showed high viscosity and increase in the shear rate, the viscosity of the shampoos drops, this is a favourable property which eases the spreading of the shampoos on hair. (Table 3)

5.5 Surface tension

The term indicates the amount of surfactant present in shampoo to reduce the surface tension. Lesser the surface tension stronger is the cleaning ability of the shampoo. A shampoo is considered of good quality if it decreases the surface tension of pure water from 72.28 dyn/cm to about 40 dyn/cm. All the tested shampoo and Dove showed similar reduction in surface tension ranging from 31.00 to 39.00 dyn/cm. The reduction in surface tension is an indication of their good detergent action. The F3 has 34.00 dyn/cm when compared to dove 31.00 dyn/cm. (Table 3)

5.6 Wetting time

The wetting ability of a surfactant is dependent on its concentration and is commonly used to test its efficacy. The canvas disc method is quick, efficient and reliable test to evaluate the wetting ability of a shampoo (Manikar and Jolly, 2000). The wetting time of three shampoo and commercial shampoo was found to be 195, 190, 178, 170 seconds. (Table 3)

5.7 Foam volume

The F3 and Dove shampoos was shown foam volume with distilled water and distilled water + soil was found to be 85 & 90ml, 98 & 110ml respectively. (Table 4)

5.8 Stability study

Accelerated stability tests showed that no significant changes over a period of time (3 months) for F3. pH, Viscosity, % of solid content, Foam volume, surface tension was stable over the study period.

6 Conclusion

In conclusion, the results showed that F3 had no significant difference in comparison to reference shampoo regarding their physicochemical properties and their *Invitro* evaluation. But further research and development is needed to improve its overall quality.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

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