



Formulation, Evaluation, and Comparison of Herbal Shampoo with Marketed Synthetic Shampoos

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Abstract

The use of natural plants and herbs to formulate shampoo is yet to be fully established in literature as an excellent replacement to the synthetic shampoo. The herbal shampoo can be used as a good replacement for synthetic shampoos, as it cleans sebum, dirt, dandruff, promotes hair growth, strengthens, and darkens the hair. Moreover, it also acts as a conditioning and moisturizing agent and performs all these actions without affecting or damaging hair. This study formulates a good herbal shampoo using natural products, devoid of any synthetic compound, and compare it to marketed synthetic shampoos for efficiency and safety. The herbal shampoo was formed using aqueous extracts of the soap nut and kola nut, with plant oils and essential oils. Fragrance oil, gum and a natural preservative was used. The shampoo was evaluated using visual assessment, physicochemical, and performance tests. The formulated herbal shampoo (FHS) had a brown color, good transparency, and odor. It also had a suitable pH of 5.52 which was very close to the pH of the scalp, thereby preventing skin irritation. It showed a detergency power of 26.19 and was able to reduce the surface tension of water to 35.4dynes/cm which is close to the 40dynes/cm mark. It also had a fast wetting time, good wash ability and high and stable foam quality. When compared with the marketed shampoos, it showed properties as good as the marketed shampoos in some tests, and even better than some shampoos in some other tests.

1. Introduction

Shampoo is considered a hair cosmetic. It is used basically to wash and clean the hair and scalp and add nutrients to them. It should do this without removing natural hair oil and nutrients. A good shampoo leaves the hair soft, lustrous, and manageable. However, there are some specialty shampoos that contain special ingredients with unusual properties, such as anti-dandruff, nutrition, etc. used to address specific scalp issues [1].

Shampoos can be transparent or opaque. They are available as liquids, gels, lotions, pastes, creams, or even dry-powder aerosols. Based on their specific functions, shampoos can be classified into the following major categories; general-purpose shampoos, conditioning shampoos, anti-dandruff shampoos, baby shampoos, and dry shampoos [2]. All shampoo formulations contain a mixture of surfactants (synthetic or natural) as cleansing and foaming agents, excipients (viscosity-controlling agents, emollients, preservatives, etc.), and active ingredients [3].

Due to the rising concerns of the adverse effects of synthetic products used in cosmetics, shampoos included, there is a need for natural products that can achieve the same result without the harsh effect brought on by synthetic chemicals. Shampoos are under cosmetics and as such there is not a strict rule for revealing every component used in preparing it. This has led to a lot of hidden unhealthy chemicals being used under the disguise of fragrances and other agents, hereby exposing the scalp and the blood stream to toxins, metals and other unhealthy products and most people are unaware of the side effects associated with these harmful synthetic ingredients [4].

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 [5].

Synthetic shampoos are shampoos made from synthetic chemicals; these are chemicals formed through a chemical process as opposed to those of natural origin. From a chemical and formulation point of view, shampoos are mainly made of washing bases, a mixture of surfactants having cleaning properties to remove dirt and dust from the scalp and hair. The presence of this mixture improves the products' performance, reducing the strong effect of a single surfactant [6]. Due to the multitude of purposes of these hair care products, they contain a long list of ingredients with various effects on the hair. In particular, a typical shampoo usually contains a mix of primary and secondary surfactants for cleaning, viscosity builders, solvents, conditioning agents, pH adjusters, and other components such as fragrance and, eventually, color for commercial appeal. Synthetic surfactants are added to shampoo primarily for the foaming and cleansing action, but their regular use leads to dryness of hairs, hair loss, irritation to the scalp and eyes [7]. It is, therefore, necessary to find a shampoo that can be effective and yet safe for human hair. People have been using herbs for cleaning, beautifying, and managing hair since the ancient era [8], and nature has so far not failed.

Herbal shampoos are made from purely natural products to cleanse the hair and give it, the desired nutrients to achieve healthy hair and scalp. The natural products used vary widely, depending on the effect one wants to get, the hair issue to be treated and the nutrient one wants to feed the hair and scalp. The herbal shampoo doesn't contain harmful ingredients unlike synthetic shampoo because the ingredients used are natural and got from natural sources. They are extracted from natural materials and are organic, therefore safe. Most of them have been tested and proven for their qualities and health benefits, and as such is very beneficial for the hair and scalp. They contain vitamins, nutrients, conditioning, and moisturizing properties that are very effective in the treatment and care of the hair and scalp.

In this study, an herbal shampoo with anti-dandruff is being formulated and as such the ingredients used are those that are known to have anti-bacteria, anti-dandruff, and conditioning properties.

2. Methodology

2.1. Materials collection and preparation

The soapnut is a foaming agent that enhances the shiny and silky nature of hair [9], plant oils, and essential oils were gotten from The Formulators Pantry, Lagos. The kolanut was procured from the local market at Ikotun, Lagos. The tests were carried out at Quality Labs, Isiohor, Benin.

Preparation: Extracts were prepared by decoction method individually as reported by Kancharla et al. and stored in well-sealed containers [10]. 48g of powdered kola nut and soap nut were individually measured and placed in a stainless-steel pot. 300ml of water was poured into the pot

and boiled till the water was about a quarter of its original volume, then filtered. The filtrate gives us the concentrated extract.

Formulation of Shampoo: The shampoo was prepared by mixing the extracts, plant oils, and essential oils together in a bowl, using a magnetic stirrer. The preservative and fragrance oil were added to the mixture, and the glycerin and gum were added last for thickening. Sufficient water was added as required. The proportions were adopted from Al Badin in which all the ingredients were mixed are shown in Table 1 [16].

Table 1: List of Materials Used in Formulation of Shampoo

Ingredients	Use	Quantity (g)
Soapnut	Foaming Agent,	30
Kolanut	Anti-Bacterial, Stimulates Hair Growth	10
Castor Oil	Anti-Dandruff Agent	10
Olive Oil	Conditioning Agent	5
Coconut Oil	Moisturizing and Conditioning Agent	5
Vitamin E Oil	Anti-Dandruff Agent	2.5
Tea Tree Essential Oil	Anti-Bacterial, Anti-Fungal Agent	1
Lemon Essential Oil	Calming, Anti-Fungal Agent	1
Fragrance (Lavender)	Scent	1
Preservative (Optiphen Nd)	Preservation Agent	1
Vegetable Glycerin	Moisturizing Agent, Pearling agent	10
Xanthan Gum	Thickener	1
Water	Solvent	AR

*AR – as required

2.2. Evaluation of the formulated and commercial shampoos

To evaluate the quality of prepared shampoo formulation and the marketed shampoo, several quality control tests including visual assessment, physicochemical controls conditioning performance tests were performed as described by [9].

2.2.1 Physical Appearance/Inspection

The formulation was evaluated in terms of clarity, color, odor and texture.

2.2.2 Determination of pH

The pH of 10% shampoo solution in distilled water was determined at room temperature 25°C [11], using a strip of pH paper in the solution and comparing the color of the strip to key.

2.2.3 Dirt Dispersion Test

One percentage (1%) solution of the shampoo (1 g of sample in 100 mL of water) was taken, and one drop of India ink was added; the test tube was stoppered and shaken ten times. The amount of ink in the foam was estimated as none, light, moderate, or heavy. Shampoos that cause the ink to concentrate in the foam are considered poor quality. The dirt should remain in the water portion. Dirt that remains in the foam will be difficult to rinse away and will be redeposited on the hair [12; 13].

2.2.4 Percentage Solid Content Test

A clean dry evaporating dish was weighed, and 4 g of shampoo was added to it. The dish and the shampoo were weighed together. The exact weight of the shampoo was calculated and the evaporating dish with the shampoo was placed on a hot plate until the liquid portion evaporated. The weight of the shampoo (solids) after drying was calculated [1]. If a shampoo has too many solids, it will be difficult to work it into the hair or to wash out. If it does not have enough solids, it will be too watery and will wash away quickly. A good shampoo has 20–30% of solids [12].

2.2.5 Surface Tension Measurement

Surface tension measurements were carried out using a solution of 10% shampoo diluted in distilled water at room temperature using a dropper [12, 13, 14, 15]. The stalagmometer/dropper was thoroughly cleaned using chronic acid and purified water since surface tension is highly affected by grease or other lubricants. Surface tension was calculated by the following equation:

$$R_2 = \frac{(W_3 - W_1) * n_1 * R_1}{(W_2 - W_1) * n_2} \quad (1)$$

Where,

W_1 is the weight of the empty beaker;

W_2 is weight of the beaker with distilled water;

W_3 is the weight of the beaker with the shampoo solution;

n_1 is the number of drops of distilled water and

n_2 is number of drops of the shampoo solution

R_1 is the surface tension of distilled water at room temperature while

R_2 is the surface tension of the shampoo solution.

2.2.6 Cleaning Action

5 grams of wool yarn were placed in grease, after that it was placed in 200 ml. of water containing 1 gram of shampoo in a flask. Temperature of water was maintained at 35°C. The flask was shaken for 4 minutes at the rate of 50 times a minute. The solution was removed, and a sample was taken out, dried, and weighed. The amount of grease removed was calculated by using the following equation:

$$DP = \left(1 - \frac{T}{C}\right) * 100 \quad (2)$$

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 [12].

2.2.7 Wetting Time

A canvas paper was cut into 1-inch diameter discs having an average weight of 0.44 g. The smooth surface of the disc was placed on the surface of 1% v/v shampoo solution and the stopwatch started. The time required for the disc to begin to sink was noted down as the wetting time [16].

2.2.8 Wash Ability

The formulation was applied on the skin and then ease and extent of washing with water was checked manually [17].

2.2.9 Foaming Ability and Foam Stability

The cylinder shake method was used. 50 mL of the 1% test shampoo solution was placed into a 250 mL graduated cylinder; it was covered with one hand and shaken 10 times. The total volume of the foam content after 1 min of shaking was recorded. Foam stability was evaluated by recording the foam volume after 1 min and 4 min of shake test [16].

2.3. Comparison of the shampoos:

The results of the formulated shampoo and the results of the marketed shampoos were tabulated and compared. It was noted that the marketed shampoos and the formulated shampoo had very good ideal properties, as they all showed good cleansing, stable foam, and good detergency power.

3. Results and Discussion

3.1. Physical Appearance/Inspection

The formulated shampoo was dark brown in color, opaque, and flowing well, with a very good scent which can be attributed to the lavender fragrance oil used in the formulation. The physical appearance of the other shampoos is shown in Table 2.

3.2. Determination of pH

The pH of the formulated shampoo is 5.52. The pH of all the shampoos tested was within the (5-7) as shown in Table 2. The pH of a shampoo is important to determine the acidity and alkalinity of the shampoo. The pH of the scalp is within the range of 5-6 (Griffin, 1977). The ideal pH range for shampoo is between 5 and 7.8 [9].

3.3. Dirt Dispersion Test

The FHS solution when shaken with the India ink, showed good dirt dispersion as the ink/ dirt remained in the water. The same occurred for the other three commercial shampoos. Shampoo that causes concentration of the dirt in the foam is a poor-quality shampoo. This will mean the dirt will redeposit on the hair as it will be difficult to rinse out [10]. The shampoos tested showed a good level of dirt dispersion as most of the dirt remained in the water.

3.4. Percentage Solid Content Test

The formulated shampoo had a 26% solid content as shown in Table 2. The solid content of the other shampoos were within the range of 20-30%. A good shampoo should not have too much solid, so it can be easily worked into the hair and scalp. the ideal percentage solid in shampoos should be between 20-30% [1]. The shampoos tested fell within this range.

3.5. Surface Tension Measurement

The herbal shampoo reduced the surface tension to 35.4 dynes/cm as shown in Table 2. Vinox reduced surface tension to 33.43 dynes/cm, Herbal essence reduced surface tension to 38.34 dynes/cm, Pantene reduced surface tension to 34.69 dynes/cm. A good shampoo should be able to reduce the surface tension of water from 72.8 dynes/cm to 40.00dynes/cm [12]. From our results we can see that the tested shampoos have good surface tension reduction ability. Al Badi and Khan reported a surface tension of 38.72 dynes/cm for their study. This shows that the FHS from this study has proven to be good [16].

3.6. Cleaning Action

The sebum in the cotton wool after being shaken in the 10% formulated shampoo solution reduced considerably from 4.2g to 3.1g, this was used to calculate the detergency power, and we got 26.19%. The same was carried out for the marketed shampoos and their results are shown in Table 2. The basic property of a shampoo is to clean. A shampoo should be able to have a good detergency power which can range from 18-33%. Although experimental detergency evaluation has been difficult to standardize, as there is no real agreement on a standard soil, a reproducible soiling process or the amount of soil a shampoo should ideally remove [18].

3.7. Wetting Time

The canvas put in the 1% formulated shampoo solution took about 25 secs to become wet and 28 secs to be fully immersed. The tested values are shown in Table 2. The tested shampoos showed remarkable 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 a quick, efficient, and reliable test to evaluate the wetting ability of a shampoo [10].

3.8. Wash Ability

The shampoos when put on the skin showed good washing ability as they were able to be washed away easily by water while cleaning and foaming properly.

3.9. Foaming Ability and Foam Stability

The shampoos were tested for its foam ability and to see how long the foam will last. The formulated shampoo produced good and stable foam. This is due to the properties of the soap nut. The results of all tested shampoos are shown in Table 2. This shows us that all tested shampoos have good and stable foam. Some shampoos showed lesser foam than others, this is due to the constituents used in them. The formulated shampoo had a medium foaming. Although foam generation has little to do with the cleansing ability of shampoos, it is of paramount importance to the consumer and is therefore important. There does not seem to be any direct correlation between detergency and foaming, which only confirms the fact that a shampoo that foams well need not clean well [16].

Table 2: Evaluation of physicochemical properties of FHS and marketed shampoo

S/No.	Formulation	FHS	Vinoz	Herbal essences	Pantene
1	Physical Appearance	Dark brown, opaque	Dark green, clear	Light brown, transparent	White, shiny
2	pH	5.52	5.65	6.04	6.54
3	Dirt dispersion	Good	Good	Good	Good
4	Percentage Solid Content (%)	26	23.75	25	23.75
5	Surface Tension (dynes/cm)	35.4	33.43	38.34	34.69
6	Cleaning Action	26.19	28.57	26.19	21.43
7	Wetting Time (sec)	25	23	28	16

8	Wash Ability		Good	Good	Good	Good
9	Foam ability and stability time	1 min	115 ml	150 ml	113 ml	107 ml
		4 mins	103 ml	136 ml	105 ml	106 ml

4. Conclusion:

From the study carried out, it can be concluded that the herbal shampoo can be formulated quite easily; the materials used can be easily and cheaply sourced from the local markets; making it economically feasible; the FHS is effective in cleaning and reducing protein loss; the FHS when tested against the marketed synthetic shampoo showed ideal properties making it a more suitable alternative for synthetic shampoos. Several tests performed to evaluate and compare the physicochemical properties of the FHS with marketed shampoos showed the FHS has superior or comparable quality.

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