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EFFICACY EVALUATION OF THE FORMULATED ORGANIC SHAMPOO BARS USING KAPOK *(Ceiba pentandra)* LEAF EXTRACTS WITH YLANG-YLANG *(Cananga odorata)* FRAGRANCE

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ABSTRACT

This study formulated organic shampoo bars using Kapok *(Ceiba pentandra)* leaf extracts with Ylang-Ylang *(Cananga odorata)* Fragrance. Through a quantitative method using true experimental design, the researchers addressed the three *(3)* scientific questions. In formulating the organic shampoo bar, the researchers adopted but modified the protocol from Dr. Edna Okuener. The formulation used a cold alkaline process by combining Kapok leaf extracts *(1g)*, coconut oil *(58.4g)*, and various additives like Glycerine *(1.16g)*, Sodium Hydroxide *(49%)*, Sodium Lactate *(0.6g)*, Citric Acid *(0.6g)*, alkaline water *(51g)*, and Water-based Ylang-Ylang *(35 drops)*. Thereafter, it was subjected to evaluation procedures to evaluate its irritation, fragrance, texture, pH level, and microbial properties. It was revealed that the formulated organic shampoo bar had not irritated the skin of the subjects. Also, after *6* attempts, the desired fragrance was attained by adding *35* drops of water-based Ylang-Ylang. Furthermore, the texture of being smooth and plain was achieved on the *2*nd attempt by accelerating the stirring of the mixture. Additionally, its pH level of *14* indicates safe to use for the skin and the scalp because of the presence of citric acid as a pH balancer. Similarly, it has an APC result that is equal to *0*, indicating its antimicrobial properties. Lastly, using the T-test, it was found that there is a significant difference between the control and treatment, meaning that the treatment is more effective since it did not irritate the skin, compared to the control which demonstrated an irritation after the *24*-hour observation.

Keywords: *Formulation, Organic Shampoo Bars, Kapok Leaf Extracts, Ylang-Ylang, Dermatological Effect Test, Fragrance, Texture, pH Level, Microbial Properties*

INTRODUCTION

Shampoo bars are solid hair cleansers that replace plastic bottles and are travel-friendly. They contain ingredients like glycerin, kapok leaf extracts, alkaline water, coconut oil, citric acid, and sodium lactate. Shampooing is essential for hygiene, dandruff prevention, and hair growth. Kapok leaves have phytochemical components like tannins, flavonoids, terpenoids, cardiac glycosides, and saponins making it a good ingredient for the formulation of shampoo. Also, Ylang-Ylang has linalool, a bioactive compound in essential oils. Irritation tests determine skin, mucosal, or ocular irritation. Scent affects consumers' buying decisions. The aerobic plate count estimates microorganism levels in food. The pH scale measures fluid acidity or alkalinity (Love Beauty and Planet, 2020).

Objectives of the Study:

This study formulated organic shampoo bars using the Kapok (Ceiba pentandra) leaf extracts with Ylang-Ylang (Cananga odorata) fragrance. To achieve this main goal, the researchers carried out these tasks:

1. Adopted but modified the protocol from Dr. Edna Okuener (2022) for formulating organic shampoo bars using Kapok (Ceiba pentandra) leaf extracts with Ylang-Ylang (Cananga odorata) fragrance.
2. Evaluated the formulated organic shampoo bars using Kapok (Ceiba pentandra) leaf extracts with Ylang-Ylang (Cananga odorata) fragrance in terms of:
   2.1 Irritation;

2.2 Fragrance;
2.3 Texture.
2.4 pH Level; and
2.5 Microbial Properties.

3. Compared the results between the control and treatment in terms of irritation.

Research Questions

In pursuit of eco-friendly formulation practices for hair care solutions through formulating shampoo bars with botanical ingredients, i.e., Kapok (Ceiba pentandra) leaf extracts with Ylang-Ylang (Cananga odorata) fragrance, the researchers provided answers to these scientific questions:

1. What is the adopted but modified protocol from Dr. Edna Okuener (2022) for formulating organic shampoo bars using Kapok (Ceiba pentandra) leaf extracts with Ylang-Ylang (Cananga odorata) fragrance?
2. What are the evaluation results of the formulated organic shampoo bars using Kapok (Ceiba pentandra) leaf extracts with Ylang-Ylang (Cananga odorata) fragrance in terms of:
   2.1 Irritation;
   2.2 Fragrance;
   2.3 Texture
   2.4 pH Level; and
   2.5 Microbial Properties?
3. Is there a significant difference between the control and treatment in terms of irritation?

Hypothesis of the Study

Ho[1] There is no significant difference between the control and treatment in terms of irritation.

Scope and Delimitation of the Study

This study formulated organic shampoo bars using Kapok *(Ceiba pentandra)* leaf extracts with Ylang-Ylang *(Cananga odorata)* fragrance using the adopted but modified protocol from Dr. Edna Okuener (2022). These organic shampoo bars using Kapok leaves contain bioactive substances good for promoting hair growth and were prepared using a cold alkaline process. Then, the researchers subjected the formulated organic shampoo bars to an evaluation process to determine its irritation, fragrance, texture, pH level, and microbial properties. Next, the significant difference between the control and treatment in terms of irritation was analyzed using T-test. Further, the study was conducted at the Nutraceutical Laboratory of Mindanao State University, General Santos City in the academic year *2022-2023*.

Limitations of the Study

In the pursuit of knowledge and the exploration of research questions, the researchers admitted that it is essential to acknowledge and communicate the limitations inherent in any study. This research endeavor is no exception, and this section aims to candidly address the constraints and boundaries that influenced the design, execution, and interpretation of the study. Thus, in the process of formulating the organic shampoo bars using Kapok leaf extracts, the researchers encountered uncontrolled occurrences such as the pungent odor of Kapok leaf extracts when mixed with other substances. It was assumed by the researchers that the interaction between the compounds present in Kapok leaf extracts and other ingredients in the shampoo bar formulation may have led to chemical reactions that produced odorous compounds. Also, the excess oil and the change of color from darker to lighter during the curing days had been attributed to reasons such as formulation adjustments, proper curing techniques, and quality control measures.

Significance of the study

The researchers believe that this scientific study will be beneficial to the following individuals and aspects.

To Environmental Science, it will help the environment by avoiding the use of harmful toxins and pesticides commonly found in conventional shampoos.

To Policy Implementation, the study suggests establishing formulation protocols and testing procedures for shampoo bars made from Kapok leaves.

To STEM Students, they may learn from this study by understanding the process of formulating a shampoo bar with Kapok leaves and the testing involved.

To the Community, they may learn about the potential benefits of Kapok leaf extracts as an alternative hair grower.

To Future Researchers, the protocol presented here can serve as a foundation for formulating various products using Kapok leaves, expanding beyond shampoo bars.

Research Gap

With the previous literature and studies, the researchers found that there may be gaps in understanding the optimal formulation parameters for organic shampoo bars and that there have been no studies conducted yet exploring the potential of Kapok leaf extracts as organic shampoo bars with Ylang-ylang fragrance. Hence, the researchers explored the ideal concentrations of Kapok leaf extracts and Ylang-ylang fragrances to maximize their beneficial properties while ensuring product stability and safety.

Furthermore, investigating the irritation capability, fragrance stability, and shelf life of organic shampoo bars formulated with Kapok leaf extracts and Ylang-ylang fragrance was crucial for product formulation since some of the cited studies revealed that these areas were the downfall of research in product development such as shampoo bars.

Conceptual Framework of the Study

This study formulated organic shampoo bars using Kapok leaf extracts with Ylang-ylang fragrance. To attain the main goal of this research, the researchers employed the input-process-output scheme to elucidate specifically the conceptual framework.

In the input, adoption but modification of the protocol from Dr. Edna Okuener (2022) for formulating organic shampoo bars using Kapok *(Ceiba pentandra)* leaf extracts with Ylang-ylang *(Cananga odorata)* fragrance was adhered to. Then, the formulated organic shampoo bars were subjected to evaluation criteria such as irritation, fragrance, texture, pH level, and microbial properties. Also, the comparison between the results of the control and treatment groups in terms of irritation was determined.

In the process, the researchers carried out the objectives of formulating the organic shampoo bars following the adopted but modified protocol to align with the needs of the study. Tests of assessment to evaluate the efficacy of the formulated organic shampoo bars were done to evaluate the potential for skin irritation, fragrance, physical texture, and consistency, compatibility with the skin and scalp, and the presence of microorganisms. Also, comparing the results obtained from the control group and the treatment group in terms of irritation potential was materialized.

By successfully realizing the input and process, the researchers were able to formulate organic shampoo bars using Kapok *(Ceiba pentandra)* Leaf Extracts with Ylang-ylang *(Cananga odorata)* Fragrance as their output.

In summary, this conceptual framework outlines the process of adopting and modifying a protocol for formulating organic shampoo bars using Kapok leaf extracts with Ylang-ylang fragrance, evaluating the formulated products based on specified criteria, and comparing the results between control and treatment groups to assess the efficacy and safety of the organic shampoo bars. The output includes the formulated shampoo bars, evaluation data, and comparison analysis results.

Figure *1* below summarizes the conceptual framework of the study.

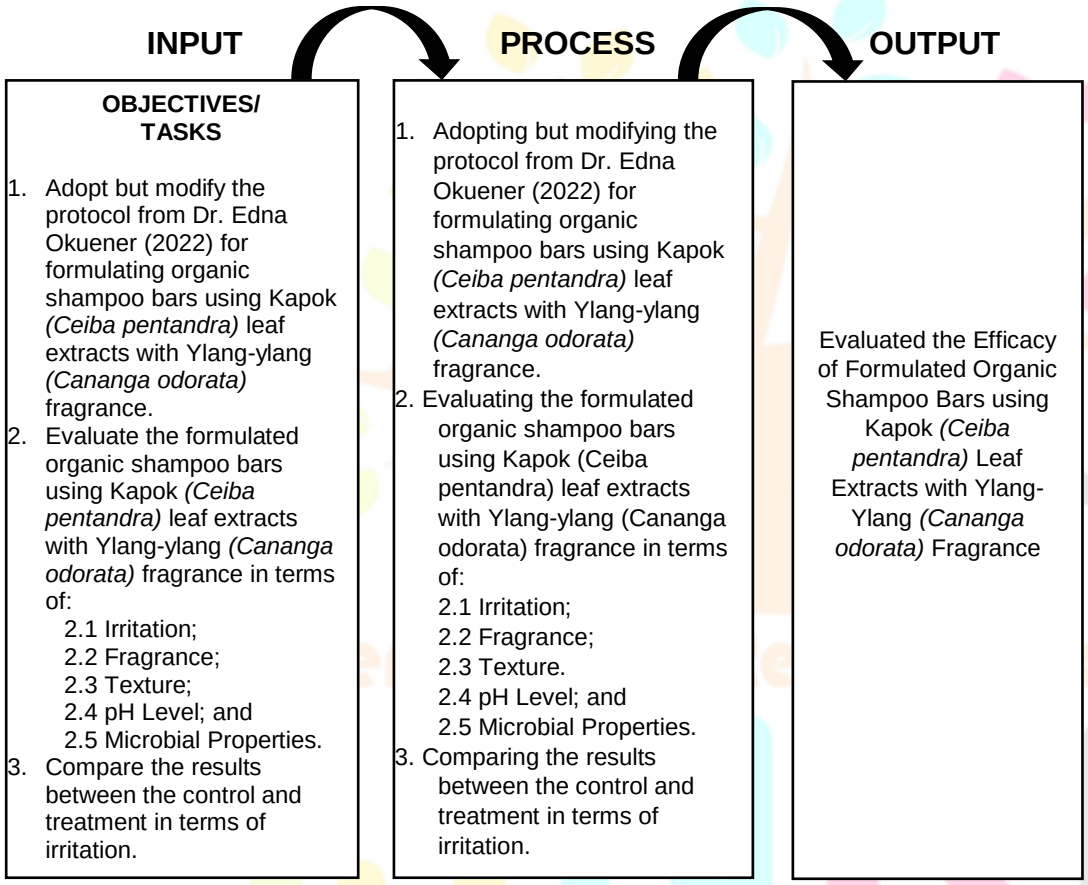

Figure 9. The Conceptual Framework of the Study

METHODOLOGY

The researchers' study used a quantitative method, specifically a true experimental design. The study focuses on scientific experimentation and employs statistical analysis in its execution (Pubrica-Academy, 2020).

Materials Used

Kapok Leaf Extracts *1*g, Coconut Oil *58.4*g, Alkaline-water Ratio *51*g, Citric Acid *0.6*g, Glycerine *1.16*g, Sodium Lactate *0.6*g, Sodium Hydroxide *49*g Ylang-Ylang fragrance *35* drops, and pH strips.

Tools Used

Beaker, Pipette, Stirring Rod, Shampoo Bar Molder, Dropper, Bowl, Spatula, and Container.

Equipment Used

Analytical Balance, Top-loading Balance, Blender, Aerobic Plate Count (APC), Water bath, Dehydrator, and Rotary Evaporator (ROTAVAP)

Paraphernalia

Surgical Mask, Laboratory Footwear, Laboratory Gown, Hair Net, and Laboratory Gloves

Procedures

A. Preparations of Materials

First, the researchers collected the materials (Kapok leaves) and then cleaned them using tap water two times to remove dirt and residues from the collection. Second, in the final washing of the Kapok leaves, distilled water was used. Third, after sanitation, the Kapok leaves were air-dried. Fourth, the materials (Kapok leaves) were dehydrated through a laboratory dehydrator and were left overnight for about *75*°C to reduce their moisture content. Fifth, when the moisture content was reduced, the researchers proceeded to grind the materials using a NutriBullet blender and soaked them (powdered Kapok leaves) using a total of *3*L ethanolic alcohol (*3*L for Kapok) for a week. Sixth, after a week, the mixture of Kapok-Ethyl alcohol was processed through filtration and rotary evaporation to generate the pure crude extracts of Kapok leaves. Lastly, the crude extracts of these materials from rotary evaporation were subjected to the water bath to achieve its consistency (syrup-like form).

B. Formulation of Organic Shampoo Bars

The researchers adopted but modified the protocol from Dr. Edna Okuener (2022) who also formulated the same product that uses a cold alkaline process in formulating the shampoo bars but instead of Plagtiki plant, the researchers opted for Kapok leaf extracts. First, the Kapok leaf extracts were mixed in different proportions to obtain the desired formulation. Second, the researchers mixed the *1*g of Kapok leaf extracts with the coconut oil mixture of *58.4*g until it became homogenous. Third, the *49%*NaOH was gently poured, hitting the glass stirrer to avoid bubbling, and gently stirred for *10* seconds. Fourth, the researchers facilitated the speed of mixing by using a hand mixer with accelerated speed until the mixture was emulsified. Fifth, they added the remaining additives (Citric Acid of *0.6*g, Glycerine of *1.16*g, *0.6*g of Sodium Lactate, and *35* drops of water-based Ylang-Ylang) and continued mixing until it reached the creamy mixture. Sixth, they poured the mixture into a soap molder and allowed it to cure for *14* days.

C. Testing the Irritation of the Formulated Organic Shampoo Bars (Dermatological Effect Test)

In determining the irritation of the formulated organic shampoo bars, the researchers utilized the patch test method. In successfully doing this method, they first gathered all the needed materials such as alcohol, patches, tissue papers, plasters, and scissors. Second, they determined ten *(10)* respondents from the Technical-Vocational and Livelihood (TVL) track specifically Grade *12* EIM (Electrical Installation and Maintenance) for the control group, encompassing *4* boys, and *1* girl, and Grade *11* SMAW (Shielded Metal Arc Welding) for the experimental group, composing of *3* boys and *2* girls, whose parents voluntarily signed the consent to allow their children to participate in the study's testing.

Furthermore, the patch test commenced by cleaning/disinfecting the wrist area of the respondents using alcohol with cotton balls. Then, the researchers applied a thick layer of shampoo bar i.e., Ecowash for the control while for the experimental group, it was the formulated organic Kapok shampoo bar on the surface of the respondents' wrist's skin. Next, they applied the patches. Once these steps were executed properly, they instructed the respondents not to remove the patches and secure them for *24* hrs. After the period of waiting, the researchers observed the respondents' skin for possible signs of irritation or itchiness that occurred.

D. Testing of Fragrance of the Formulated Organic Shampoo Bars

The fragrance test helped assess the quality and appeal of the scent derived from Kapok leaf extracts. It allowed for determining whether the scent was pleasant, natural, and aligned with the desired aroma profile for the shampoo bar. Hence, in this study, the researcher performed six *(6)* attempts of adding fragrances to the formulated organic shampoo bars (Kapok Leaf Extracts) using water-based Ylang-Ylang and Oil-based Cantaloupe fragrances for comparison.

E. Testing of Texture of the Formulated Organic Shampoo Bars

The texture test helped assess the consistency of the formulated organic shampoo bars, including its firmness, smoothness, and overall feel. This is important for ensuring that the product delivers a satisfactory experience during use, from application to rinsing. Thus, in the study, the researchers performed two *(2)* attempts until they reached the desired texture of the formulated organic shampoo bara.

F. Testing of pH Level of the Formulated Organic Shampoo Bars

The pH level of a shampoo bar is crucial for maintaining the natural pH balance of the scalp and hair. Ideally, the pH of the shampoo should be slightly acidic, similar to the natural pH of the scalp, which typically ranges from *4.5* to *5.5*. Using a shampoo with a pH that is too high or too low can disrupt the scalp's natural acid mantle, leading to issues such as dryness, irritation, or excessive oiliness. Hence, in this study, the researchers tested the formulated organic shampoo bars' pH by using a digital pH meter to measure their pH level and acidity. Three *(3)* trials were executed during the testing.

G. Testing the Microbial Properties of the Formulated Organic Shampoo Bars Through Aerobic Plate Count (APC) Method

Microbial testing helped ensure that the formulated organic shampoo bars were free from harmful microorganisms such as bacteria, fungi, and molds. These microorganisms can pose health risks to consumers, especially when applied to the skin or scalp, leading to infections or other adverse reactions. Ensuring the product's microbial safety is essential for protecting consumer health and safety. Thus, the researchers subjected the formulated organic shampoo bars to microbial testing through the Aerobic Plate Count (APC) method, a microbiological method used to estimate the total number of aerobic bacteria present in a sample. In executing the APC, the researchers prepared the materials, collected the samples of formulated organic shampoo bars, prepared the dilutions, performed the inoculation and incubation, counted the colonies, and calculated and reported the results.

Variables of the Study

The independent variable of the study was the formulated organic shampoo bars with the Kapok leaf extracts and Ylang-ylang fragrance, while the dependent variables of the study were the irritation, fragrance, texture, pH level, and microbial properties of the formulated organic shampoo bars. On the other hand, the controlled variable of the study was the Ecowash, a commercial shampoo bar used for comparative analysis of the evaluation tests.

Data Gathering Techniques

The researchers utilized the following techniques in arriving at the results of different evaluation tests conducted:

For the irritation test, the researchers used a patch test. One *(1)* represents there is no irritation and two *(2)* represents there is an irritation.

For the fragrance test, six *(6)* attempts of adding fragrances to the formulated organic shampoo bar (Kapok Leaf Extracts) using water-based Ylang-Ylang and Oil-based Cantaloupe fragrances were done where increasing number of drops of each type of scent was added until the desired fragrance was achieved.

For the texture test, two *(2)* attempts until the researchers reached the desired texture of a shampoo bar were done. The same amount of ingredients was used but with different speeds of stirring.

For the pH level test, three *(3)* replicates were tested using the digital pH meter.

For the microbial properties test, the researchers subjected the samples of the formulated organic shampoo bars to Aerobic Plate Count where the reference of microbiological limits (CFU/g) is ≤*1000* by Maturin and Peeler (2001).

Statistical Analysis

The acceptance or rejection of the null hypothesis if there was a significant difference in the dermatological effect test results between the treatment and control groups, T-test was used. All tests were done at a *0.05* level of significance.

RESULTS AND DISCUSSIONS

Formulation of the Organic Shampoo Bars

The researchers adopted but modified the protocol from Dr. Edna Okuener (2022) who also formulated the same product that uses a cold alkaline process in formulating the shampoo bar but instead of Plagtiki plant, the researchers opted for Kapok leaf extracts. First, the Kapok leaf extracts were mixed in different proportions to obtain the desired formulation. Second, the researchers mixed the 1g of Kapok leaf extracts with the coconut oil mixture of 58.4g until it became homogenous. Third, the 49%NaOH was gently poured, hitting the glass stirrer to avoid bubbling, and gently stirred for 10 seconds. Fourth, the researchers facilitated the speed of mixing by using a hand mixer at an accelerated speed until the mixture was emulsified. Fifth, they added the remaining additives (Citric Acid of 0.6g, Glycerine of 1.16g, 0.6g of Sodium Lactate, and 35 drops of water-based Ylang-ylang) and continued mixing until it reached the creamy mixture. Sixth, they poured the mixture into a soap molder and allowed it to cure for 14 days.

Shampoo bars are solid hair cleaners that eliminate the need for plastic bottles, making them ideal for travel. They work like liquid shampoos and come in soap bar form. Their effectiveness and impact on the hair must be considered when creating them. Ingredients are necessary for their production (Ramsay & Cobral, 2020).

Evaluation of the Formulated Organic Shampoo Bar Using Kapok Leaf Extracts with Ylang-Ylang Fragrance

This study subjected the formulated organic shampoo bar using Kapok leaf extracts with Ylang-Ylang fragrance to evaluation procedures to determine its irritation, fragrance, texture, pH level, and microbial properties. Tables *1-5* show the generated results from the evaluation tests performed.

A.) Dermatological Effect Test (Test of Irritation)

This study conducted a dermatological effect test of the formulated organic shampoo bar using Kapok leaf extracts through a patch test. This test was a diagnostic exam that the researchers used to determine whether formulated organic shampoo bars resulted in skin irritation or an allergic reaction. It utilized *5* students from Grade *11* SMAW (Treatment Group) and *5* students from Grade *12* EIM (Control Group) who willingly participated to be the subjects of the testing. The formulated organic shampoo bar was applied to their wrist for *24* hours of observation. Table *1* shows the results of the patch test.

Table 1. Dermatological Effect Test (Test of Irritation) Results

RESPONDENTS (G-12, EIM)	CONTROL (ECOWASH)	RESPONDENT (G-11, SMAW)	TREATMENT (EGOBAR)
R1	2	R1	1
R2	2	R2	1
R3	2	R3	1
R4	2	R4	1
R5	1	R5	1

Legend: 1 represents no irritation while 2 means there is irritation

The researchers used a patch test. One *(1)* represents there is no irritation and two *(2)* represents there is an irritation, to determine the irritation experienced by *5* respondents from Grade *12* EIM and Grade *11* SMAW. They used a small patch on the skin. First, they cleaned the area with alcohol, applied a thick layer of shampoo bar, and waited for *24* hours to see if there was irritation. After the time set for observation, the results revealed that the respondents did not experience any irritation because of the presence of sodium lactate which is a humectant moisturizer, and sodium hydroxide a pH balancer.

These results conform to Franklin's study in *2013* on Kapok extracts as an organic hair grower shampoo bar. It kills bacteria and fungus and has antioxidant, anticancer, anti-inflammatory, cardioprotective, and immune system-promoting properties. It protects skin from UV rays and has the potential for medical and pharmaceutical use. Terpenes enhance skin penetration and treat inflammatory diseases.

B.) Fragrance

Also, the researchers performed six *(6)* attempts of adding fragrances to the formulated organic shampoo bar (Kapok Leaf Extracts) using water-based Ylang-Ylang and Oil-based Cantaloupe fragrances. The table below shows the comparative results.

Table 2. Fragrance Test Results

ATTEMPTS	NUMBER OF DROPS	DESCRIPTION OF FRAGRANCE
1st Attempt Using Water-Based Ylang-Ylang	20	Pungent
2nd Attempt Using Water-Based Ylang-Ylang	20	Pungent
3rd Attempt Using Oil-Based Cantaloupe	25	Neutral
4th Attempt Using Oil-Based Cantaloupe	30	Neutral
5th Attempt Using Water-Based Ylang-Ylang	25	Neutral
6th Attempt Using Water-Based Ylang-Ylang	35	Quite Fragrant

The table above shows that the oil-based Cantaloupe fragrance along with water-based Ylang-Ylang with *20-25* drops exhibited a neutral scent, while the water-based Ylang-Ylang with *35* drops demonstrated a quite fragrant result. Hence, the researchers since they could not fully cover the pungent scent of Kapok leaf extracts, settled on the last attempt which was using water-based Ylang-Ylang with *35* drops with at least quite a fragrant smell of Ylang-Ylang.

The primary function of fragrance as an ingredient in these products is to conceal offensive aromas or odors produced by other active chemical ingredients. However, cosmetic companies use fragrances to position their brands, differentiate their products from those of competitors, and attract consumers (FDA, 2016).

C.) Texture

In evaluating the texture of the formulated organic shampoo bar using Kapok leaf extracts, the researchers performed two *(2)* attempts until they reached the desired texture of a shampoo bar. Table *3* below shows the complete results of the two *(2)* attempts made.

Table 3. Texture Evaluation Results

ATTEMPT	REAGENTS	QUANTITY	SPEED OF STIRRING	DESCRIPTION
1ST	Kapok Leaf Extracts	1g	Slow	Rough
	Coconut Oil	58.4g		
	Sodium Lactate	0.6g		
	Sodium Hydroxide	49g		
	Citric Acid	0.6g		
	Alkaline Water	51g		
	Glycerine	1.16g		

	Ylang-Ylang Fragrance	20 drops		
2ND	Kapok Leaf Extracts	1g	Fast	Smooth and Plain
	Coconut Oil	58.4g		
	Sodium Lactate	0.6g		
	Sodium Hydroxide	49g		
	Citric Acid	0.6g		
	Alkaline Water	51g		
	Glycerine	1.16g		
	Ylang-Ylang Fragrance	20 drops		

The results of the texture evaluation show that the standard texture of the shampoo bar was achieved by the researchers on the *2*nd attempt. Although it could be construed from the given measurements and quantity of the reagents included in the formulation, constant speed, i.e., fast stirring importantly affects the results of the shampoo bar's texture. Hence, on the 2nd attempt, the researchers decided to accelerate their stirring of the mixture, thereby giving the desired outcome of a smooth and plain organic shampoo bar using Kapok leaf extracts.

D.) pH Level Testing

This study tested the pH level of the formulated shampoo bar using Kapok leaf extracts. To determine its ph level, a pH meter was used. The results below indicate the pH level of the product formulated.

Table 4. pH Level Results

SAMPLE	REPLICATE	pH Level
Formulated Organic Shampoo Bar Using Kapok Leaf Extracts	R1	14
	R2	14
	R3	14
	Average: 14	

The result of pH level testing shows that the formulated organic shampoo bar using Kapok leaf extracts is in level *14*, which means it is good for the skin and the scalp because of the presence of citric acid which was known to be a pH balancer.

According to The Sublime Life, Curators of Clean Beauty report of December *11, 2021*, the pH scale ranges from *1* to *14*, with *7* being neutral. Skin and hair are affected by pH, with a healthy scalp at *3.5* and hair at *4.5-5.5.* Using proper products maintains the balance, but incorrect ones can throw it off and leave hair dry and dull. Acidic products compress the cuticle for stronger, shinier hair, while alkaline products open the cuticle and cause frizz. Avoid products below 3 or above 6, and microbial activity thrives at a pH of *6.5-7*.

E.) Microbial Property

To test if the formulated organic shampoo bar using Kapok leaf extracts has microbial properties, the researchers subjected their product to Aerobic Plate Count (APC). This test was done to indicate the level of microorganisms in the formulated product. Table *5* below shows the results of the APC.

Table 5. Aerobic Plate Count (APC) Results

Laboratory Sample Number	**Test/Parameter: Aerobic Plate Count**		**R-E-S-U-L-T** (CFU/g)	**Microbiological Limits** (CFU/g)
	Method: Spread Plate			
	Sample ID	**Sample Description**		
23-015-029	Kapok	Shampoo Bar	**0**	**≤1000**

The APC result shows that it is equal to *0*. The formulated organic shampoo bar is considered to have an antimicrobial property if it is *0* less or equal to *1000*, a good thing that the Kapok shampoo bar has an APC that is equal to *0* because Kapok leaf extract is known for its antioxidants, and antimicrobial properties as well as the Ylang-Ylang fragrance that has antibacterial, antifungal, and anti-inflammatory properties.

Kapok surpassed Dr. Sharma's study in *2010* in fungal enrichments. Dilute the sample in Sabouraud's dextrose broth and incubate on PDA, MEA, or Sabouraud's dextrose agar. The goal was to identify tetanus bacillus. Kapok showed *0* microbial organisms after *48* hours, proving it as an effective antimicrobial for shampoo and beyond.

Significant Difference in the Dermatological Effect Test (Test of Irritation) Between Control and Treatment

After the dermatological effect test was done, the researchers subjected the results to statistical treatment and analysis to determine the significant difference in the dermatological effect test results between the treatment and control groups. Using T-test, table *6* below shows the generated results.

Table 6. Difference in the Dermatological Effect Test (Test of Irritation)

	CONTROL	TREATMENT
Mean	1.8	1
Variance	0.2	0
Observations	5	5
Hypothesized Mean Difference	0	
Df	4	
t Stat	4	
P(T<=t) one tail	0.008065	
T Critical one-tail	2.131847	
P(T<=t) two-tail	0.01613	
t Critical two-tail	2.776445	

The results of the comparative measure of the control (commercial shampoo bar) and treatment (formulated organic shampoo bar) show that there is a significant difference between the control and treatment which means that the formulated organic shampoo bar using Kapok leaf extracts exhibited no irritation on the skin as it was used by the human subjects, compared to the commercial shampoo bar which demonstrated an irritation after the *24*-hour observation.

This result conforms with the FDA (2016) that said organic shampoos are often marketed as being less likely to cause irritation compared to synthetic shampoos because of their natural ingredients, avoidance of harsh chemicals, and mild formulations. However, it is important to note that while organic shampoos are generally considered to be less likely to cause irritation, this is not a guarantee that everyone will have the same experience. People can still have individual sensitivities or allergies to specific natural ingredients, such as essential oils or botanical extracts. Therefore, it is essential to read the ingredient list carefully and perform a patch test before using any new product, regardless of whether it is organic or synthetic.

Summary of Findings

The formulation of an organic shampoo bar was successfully performed using the adopted but modified protocol from Dr. Edna Okuener (2022). First, the Kapok leaf extracts wer mixed in different proportions to obtain the desired formulation. Second, the researchers mixed the 1g of Kapok leaf extracts with the coconut oil mixture of 58.4g until it became homogenous. Third, the 49%NaOH was gently poured, hitting the glass stirrer to avoid bubbling, and gently stirred for 10 seconds. Fourth, the researchers facilitated the speed of mixing by using a hand mixer at the lowest speed until the mixture was emulsified. Fifth, they added the remaining additives (Citric Acid of 0.6g, Glycerine of 1.16g, 0.6g of Sodium Lactate, and 35 drops of water-based Ylang-Ylang) and continued mixing until it reached the creamy mixture. Sixth, they poured the mixture into a soap molder and allowed it to cure for 14 days.

After the formulation, the researchers evaluated its irritation, fragrance, texture, pH level, and microbial properties. It was revealed that the formulated organic shampoo bar using Kapok leaf extracts with Ylang-ylang fragrance has caused no irritation on the skin of the subjects involved in the dermatological test. Also, after 6 attempts, the researchers were able to attain the desired fragrance of the shampoo bar by adding 35 drops of water-based Ylang-Ylang. Although it did not fully cover the scent of Kapok leaf extracts, at least it gives quite the scent of Ylang-Ylang when smelled.

Furthermore, the results of the texture evaluation show that the standard texture of the shampoo bar was achieved by the researchers on the 2nd attempt by accelerating the stirring of the mixture to produce the desired outcome of a smooth and plain organic shampoo bar. Additionally, pH level testing shows that the formulated organic shampoo bar is at level 14, which means it is good for the skin and the scalp because of the presence of citric acid which is known to be a pH balancer. Similarly, the Kapok shampoo bar has an APC that is less than 1, indicating its antimicrobial properties. Lastly, the results of the comparative measure of the control (commercial shampoo bar) and treatment (formulated organic shampoo bar) show that there is a significant difference between the control and treatment which means that the formulated organic shampoo bar using Kapok leaf extracts exhibited no irritation on the skin as it was used by the human subjects, compared to the commercial shampoo bar which demonstrated an irritation after the 24-hour observation.

Conclusions

This study concluded that the materials used for the formulation of organic shampoo bars were organic due to the plant-based extracts and oil that were mixed to make the product. After the product's evaluation procedures, it was revealed that the formulated shampoo bars showed no irritation among the sample subjects used, had a smooth and plain texture when accelerated stirring was performed, produced quite a fragrance of Ylang-ylang, was skin-friendly and exhibited antimicrobial activity. Furthermore, when the control (commercial shampoo bar) and experimental/treatment (formulated organic shampoo bars) were subjected to comparative analysis, it was found that the treatment was way more effective than the control since it demonstrated no irritation during the dermatological effect test compared with the latter.

Recommendations

1. Future researchers may change the fragrance.
2. Future researchers may add more citric acid as it is a pH balancer.
3. Also, future researchers may dwell on studies relating to other uses of Kapok leaves apart from making it an organic shampoo bar.

References

Franklin, G. (2013). *Hypoglemic properties of the aqueos exact from the stem bark of ceiba pentandra in dexamethasone-induced insulin-resistant rats*. Retrieved from: https://doi.org/10.1155/2018/4234981 on January 12, 2023.

Food and Drug Administration (FDA) (2016). *Hair products*. Retrieved from: https://www.fda.gov/cosmetics/cosmetic- products/hair-products on March 21, 2023.

Love, Beauty, and Planet (2020). *How to use a shampoo bar*. Love Beauty and Planet. Retrieved from: https://www.lovebeautyandplanet.com/us/en/the-love-beauty-planet-movement/our-purpose/our-blog/how-to-use-a-shampoo-bar.html on February 12, 2023.

Okuener, E. (2022). *Formulating shampoo bar using Plagtiki*. A study from Mindanao State University, General Santos City.

Pubrica Academy (2022). Skin microbiota: microbial community structure and its potential association with health and disease. Infection, genetics, and evolution: *journal of molecular epidemiology and evolutionary genetics in infectious diseases*, 11(5), 839–848. https://doi.org/10.1016/j.meegid.2011.03.022

Ramsay, I. & Cobral, Q. (2020). Shampoo bar. Retrieved from: https://static1.squarespace.com on March 02, 2023.

Sharma, A. (2010). *In vitro antioxidant potential of the edible flowers of Bombax ceiba—an underutilized tropical tree.* In Proceedings of the 6th International Conference on Recent Trends in Engineering, Science & Management, Punjab, India, 8 January 2017; pp. 364–374.

The Sublime Life, Curators of Clean Beauty (2021). *Is your skin not working as intended? pH must be the first thing you should check.* Retrieved from: https://sublimelife.in/blogs/sublime-stories/is-your-skincare-not-working-as-intended-ph-balance-must-be-the-first-thing-you-should-check on April 20, 2023.