Scientific Research Publishing

Open Journal of Applied Sciences, 2025, 15(4), 1008-1016
https://www.scirp.org/journal/ojapps
ISSN Online: 2165-3925
ISSN Print: 2165-3917

Assessment of the Quality of Some Toilet Soaps Sold in Cameroon

Guy Bertrand Tamne*, Adeline Gaelle Kissock A Yoh, Guy Hector Fendoung Dejiang

Department of Chemistry, Higher Teacher Training College, University of Yaounde I, Yaounde, Cameroon
Email: *tamneguy@yahoo.fr, *guy.tamne@univ.yaounde1.cm

How to cite this paper: Tamne, G.B., Kissock A Yoh, A.G. and Fendoung Dejiang, G.H. (2025) Assessment of the Quality of Some Toilet Soaps Sold in Cameroon. *Open Journal of Applied Sciences*, **15**, 1008-1016.
https://doi.org/10.4236/ojapps.2025.154069

Received: March 19, 2025
Accepted: April 14, 2025
Published: April 17, 2025

Abstract

This work aims to evaluate the quality of ten (10) toilets soaps (Carimo Metiss, Keje, Derma Délice, Nature Claire Prestige, Bof Love, Pafic, Terminator, clear plain soap, Carimo nature Moringa soap) sold in Cameroon. The analytical method used to achieve this is the dosage and parameters such as: total free alkali, pH, moisture level, total fat, foam height and water-insoluble matter have been measured. It appears from the results obtained that the pH of our soaps varies from 7.5 to 10. Compared to the values of the international standard, these results confirm the alkaline nature of the soaps used, as for the content of insoluble materials in water, it varies from 1.25% to 7.35%. The latter being much higher, this implies the presence of impurities in these soaps. In addition, the total free alkali content, on the other hand, varies from 2.6% to 8.5% reflecting the complete or incomplete saponification of these soaps. Regarding the moisture content of the soaps used, the latter varies between 12.4% and 75.8% thus reflecting the strong presence or absence of water in these soaps. Moreover the foam height results obtained are of the order of 25 to 600 mL, which can be reflected in the use of active strains when formulating soaps with a high foam height and the use of certain oils for soaps with a low foam height. Furthermore, the total fat content of the soaps used varies from 26.064% to 74.670%, these values reflect that among the soaps used seven (7) soaps (Carimo Metiss, Keje, Derma Délice, Nature Claire Prestige, Bof Love, Nature Love, Pafic) are suitable for dry skin and the other three are intended for oily and normal skin. To conclude, the results obtained show that parameters such as fat and pH are key factors to be taken into account when determining the quality of a soap.

Keywords

Soaps, Quality Assessment, pH, Total Fat, Total Free Alkali, Water-Insoluble Matter, Moisture Content

1. Introduction

The skin, as the largest organ of the human body, plays a crucial role in retaining essential chemicals and nutrients while protecting the body from harmful substances and the sun's ultraviolet rays. To maintain skin health, the use of skin soaps is necessary as the skin is exposed to many aggressors throughout the day, such as insect bites, germs, harsh pollutants and the harmful effects of the sun.

Toilet soaps are an integral part of our daily body hygiene routine. For thousands of years, they have been used, and they have evolved over time to become sophisticated cosmetic products offering a multitude of properties and fragrances. Beyond their cleaning function, toilet soaps are also appreciated for their moisturizing, soothing and fragrant properties [1].

However, poor quality soaps can cause skin discomforts such as acne, eczema, rashes, skin irritation and eventually lead to cancer. The chemical characteristics of a soap depend on several factors: the strength of the alkali, the efficiency of the saponification reaction, the source of raw materials and the type of oil used for soap production [2]-[4].

The characteristics of a good soap must meet the needs of the consumer and thus their satisfaction. There are currently several soap manufacturing and production Industries in Cameroon. However, these soaps, directly sold to consumers, are manufactured according to the manufacturer's own formulations and specifications, rather than to an official quality specification. Even if these specifications can influence marketing [5] [6]. Hence the need for constant monitoring of the quality of commercially available toilet soaps is important.

Soap is a liquid or solid product obtained by chemical reactions between a fatty substance and a strong base, specifically sodium hydroxide for hard soaps and potassium hydroxide for liquid soaps. It is composed of amphiphilic molecules. It is a salt of a fatty substance of potassium and sodium. The soap-forming reaction is carried out hot or cold [7].

In Cameroon, the qualities of a good toilet soap have been set by the Cameroon Agency for Standards and Quality [8]. In the absence of any indications on the packaging indicating compliance with the Cameroonian standard on toilet soaps or other standards, this work aims to analyze the physicochemical parameters of some toilet soaps produced in Cameroon in order to assess their qualities.

2. Materials and Methods

2.1. Experimental Design and Sample Collection

The Cameroonian market is full of a multitude of soaps produced by small and large local companies. For our study, we obtained ten (10) pieces of soaps in the markets of the city of Yaoundé in Cameroon. The choice was made by chance and all these soaps are produced locally. The bar soaps were removed from the wrapper and chopped into small pieces.

2.2. Moisture Content

A mass of each soap (5 g) was weighed accurately using an analytical balance with

a sensitivity of 0.001 mg and placed in a crucible. The latter was previously weighed and dried. The crucible containing the soap was placed in an oven for 2 hours and temperature of 101˚C. The whole was weighed regularly until we obtained a constant mass. The percentage of humidity (% humidity) was calculated using the following formula [9]:

$$\%\ \text{moisture} = \frac{C_S - C_L}{C_S - C_W} \times 100$$

where C_W = Weight of crucible, C_S = Weight of crucible + sample, C_L = Weight of crucible + sample after floating.

2.3. pH

The pH was measured with a Bench Meter brand pH meter. 1 g of each soap was dissolved in 10 ml of distilled water and stirred for 2 minutes [10]. After calibrating the pH meter using two buffer solutions, the reading was taken by immersing the pH meter electrode in each solution. Each measurement was carried out three times and the average value was retained.

2.4. Foaming Power

The operating protocol consists of introducing 2 g of soaps into a graduated test tube of 500 mL then adding 100 mL of distilled water. The soap is then allowed to dissolve completely and the solution is shook (past tense of shake) for 2 minutes to create the foam. The test tube is then left to rest for 10 minutes, finally the height of the column of foam thus formed is measured. This makes it possible to evaluate the foaming power of the soap [11].

2.5. Matter Insoluble in Water

The analysis of water insoluble matter was determined by a method described by the American Oil Chemists Society (AOCS). 5 g of soap sample was dissolved in 50 ml of hot ethanol and quantitatively transferred to a pre-weighed filter paper. The residue was put in an oven at 105˚C for 30 minutes, cooled and weighed again, then the reading was taken. Calculations were made using the following formula [12]:

$$\%\ \text{matter insoluble in water} = \frac{m_2 - m_1}{m} \times 100$$

where m_1 = weight of filter paper weigh, m_2 = weight of sample + filter paper, m = weight of the sample.

2.6. Total Fatty Substance

A revised method was used to obtain total fatty substance. 10 g of each soap were added in 150 mL of distilled water and heated. While heating the soap solution was dissolved in 20 ml of 15% H_2SO_4 until clear solution was formed. Fatty matter was solidified by adding 7 g of bee wax and reheated. Then the system was allowed to cool down to form a cake. The cake was removed and blotted to dry. The cake

was weighed to obtain total fatty matter by using the formula given below [13].

$$\% \text{ TFM} = \frac{A - X}{W} \times 100$$

where A = Weight of wax + oil, X = weight of wax samples, W = weight of soap.

3. Results and Discussions

3.1. Analysis of the pH

pH is an essential parameter for determining the quality of soap. **Table 1** presents the results of the pH test carried out on our different samples of Cameroonian soaps. We observe that these values vary between 8.60 (soap bof love) which has the smallest pH value and 10 (soap Morinaga) which has the highest pH value. These pH are between 8 for milder soaps and 11 for more alkaline soaps. Our soaps are therefore the result of saponification. The pH of healthy human skin is generally between 5.5 and 6.5 [14]. We can therefore easily see that the pH of our soaps is higher than that of the skin. The pH of the skin is that of the hydrolipidic film which constitutes its protective layer. Bacteria cannot survive in this environment because it is acidic. It is therefore important to respect the natural pH of our skin to protect it. The use of a soap with a physiological or neutral pH is required. The acceptable limits of pH in soaps defined by the standard organization of Nigeria (SON) are between 6.5 and 8.5 [3]. For standard organization of Cameroon, the pH must be alkaline (pH > 7) [8]. In the case of our soaps, the alkaline nature serves as a barrier against abnormal bacterial flora and viruses by neutralizing the protective acidic nature of the body. We will note that soaps with a pH lower than 5 and higher than 10 may cause irritation on the skin and hands. With regard to basic soaps, the alkali present is released upon contact with water and increases the pH of the skin. The use of soap with a high pH causes an increase in the pH of the skin, which leads to an increase in the dehydrating effect, irritation and an alteration of the normal bacterial flora of the skin. After all these remarks we can conclude that all our soaps studied have their pH < 11 so even if the alkali present in these soaps is released, the pH of the skin cannot increase to reach the value of 11, therefore these values are in accordance with the standards of soaps, which having an alkaline pH between 8 and 10, having the property of solidifying and acting as a cleaning agent [15].

3.2. Analysis of Moisture Content

The shelf life of a product can be assessed by its moisture content. The moisture content of our different soaps has been calculated. The results are gathered in **Table 1**. It is clear from the examination of this table that the moisture content of our soaps varies from 12.4% (Keje soaps) to 75.8% (Moringa soap). According to the standard established and mentioned in the Encyclopedia of Industrial Chemical Analysis (EICA), the acceptable range for the moisture content of soap is between 10% and 15%. We can therefore conclude that Keje soap (12.4%), Carimo Metiss (13.8%), Carimo Nature soap (14%), and Pafic soap (12.8%) meet the

Table 1. Physicochemical analysis of some soap in Cameroon.

Commercial name of soap	pH	Moisture content (%)	Total fatty matter (%)	Foam height (mL)	Water insoluble matter (%)	Alcali total libre (%)
Carimo métis	9.29	13.8	74.67	350	6	4.5
Keje	9.10	12.4	58.61	450	5	2.6
Carimo nature	8.99	14	43.08	480	7	3.89
Derma délices	9.93	41.2	54.18	125	1.25	6
Nature Claire prestige	9.76	33.4	58.71	25	1.65	7.5
Bof love	8.60	32	57.55	500	1.95	5.66
Terminator	9.71	30.8	43.03	450	7.35	8.5
Nature clair	9.98	34.2	55.84	125	4.3	4.3
Pafic	8.89	12.8	52.36	450	6.15	4.1
Moringa	10	75.8	26.06	10	1.2	8

standard and can be considered good quality soaps. A correct moisture content contributes to the good conservation and durability of the soap. Their storage over a long period could not cause deterioration induced by water. On the other hand, the moisture content of soaps (derma délice, nature claire, Savon bof love, Savon Terminator, nature claire soap, Moringa soap) are really out of the norm. This may be explained by an increase in free fatty acid levels, facilitated by the reaction of unsaponified fats, or prolonged exposure to humidity during the manufacture or storage of these different soap samples. A high use of wet and unsealed ingredients can also promote humidity. Ultimately, high humidity can lead to an alteration of the quality of the soap, and promote the growth of bacteria or mold [11].

3.3. Analysis of Foam Height

Foaming power is an important parameter for the acceptability of soap. Table 1 above shows the foaming power of our different samples of soaps purchased in the market and manufactured in Cameroon, these different heights vary between 25 and 600 mL. At the end of the interpretation of our results, we can say with certainty that soaps such as (carimo nature, carimo métisse, keje, nature claire, pafic, Terminator, bof love) indicate a high and stable foam height even after 10 minutes, this may be due to the fact that these different soaps contain foaming agents or surfactants which promote the formation of abundant bulbs; or it may be due to the high concentration of cleaning ingredients or thickening agents which strengthen the structure of the foam. On the other hand, the three other remaining soaps (moringa, nature claire prestige, derma délisse) indicate a low and non-persistent foam height that gradually disappears, this may be due to a gentle and non-irritating formulation that favors gentle cleaning without producing abundant foam, or a low foam may be the result of a lower concentration of foaming agents or the use of natural ingredients that produce fewer bubbles, or we can consider a light foam as being less aggressive for the skin and suitable for

sensitive skin. It is important to note that the foaming power of a soap does not necessarily determine its cleaning effectiveness. Because some soaps with a low foam can still be very effective in removing impurities, while an abundant foam does not always guarantee deep cleaning. In conclusion, the interpretation of a soap's foaming power depends on individual preferences for texture, feel, and cleaning effectiveness. It is recommended to try different types of soaps to find the one that best suits your needs and your skin type.

3.4. Total Fatty Matter

Total fatty mater is a really important parameter in the analysis of toilet soaps, it helps determine the quality of the soap. The results obtained are gathered in **Table 1**. It emerges from the analysis of this figure that the fat values of our soaps vary between 74.67% (carimo metiss soaps) and 26.064% (moringa). A high fat content can explain the use of vegetable oils or ingredients rich in essential fatty acids in the formulation of the soap. These fats can provide moisturizing, nourishing and protective properties to the skin, leaving a feeling of softness and suppleness after use. Thus, a total fat content greater than 55% is good for dry skin because it re-hydrates the skin and makes it smooth [16]. Excess oil in a soap acts as a lubricant that lasts on the skin all day long. In view of this we can say that soaps such as (Carimo Metiss, Keje, Derma Délice, Nature Claire Prestige, Bof Love, Nature Love, Pafic) are soaps intended for dry skin. On the other hand, soaps with a low fat content indicate a lighter formulation and less rich in oils in the soap. These soaps may be more suitable for normal and oily skin that does not need excessive hydration and prefers a feeling of ownership without greasy residue; these soaps also have the ability to cleanse deeply without leaving a greasy film on the skin. A low total fat content is due to the hydrolysis of sodium in the soap [12]. It is also important to note that the fat content in a soap can influence its moisturizing properties, texture, softness, and cleaning power. However, choosing between a soap with a high or low fat content will depend on your skin's specific needs, your personal preferences in terms of texture and feel, as well as the desired effects (hydration, deep cleansing, etc.). It is recommended to know your skin type.

3.5. Water Insoluble Matter

Water insoluble matter is often used to assess the purity of a soap or to identify impurities in a soap. **Table 1** above shows the amounts of water insoluble matter contained in our soap samples. In the analysis of water insoluble matter, we observe that our results vary between 1.2% (Moringa soap) and 7.35% (Terminator soap). From these different results we can say that the soaps (Derma Délice (1.25%), Moringa (1.2%), Bof love (1.95%), Nature Claire Prestige (1.65%)) have low amounts of water insoluble matter. These values are slightly higher than 0.50 which is the maximum value set by the Standards Organizations of Nigeria (SON). These soaps contain few residues or impurities. This could reflect an effective formulation, an indicator of good quality of soaps. These insoluble materials could be either waxes

(beeswax), fats insoluble in water. These results are contrary to those obtained by Nangbes during the study on the quality of toilet soaps sold in the markets of Nigeria [17]. On the other hand, the six (6) other soaps have high quantities of insoluble materials. This situation is worrying and could mean that these soaps contain an excess of non-soluble residues or impurities, thus reflecting a level of heavy metals that are aggressive to the skin.

3.6. Free Alkali Content

The total free alkali content is the sum of the free caustic alkali and free carbonate alkali contents. **Table 1** above illustrates the measurements of the total free alkali content of our different samples of soaps manufactured and sold in Cameroon.

The total free alkali content of toilet soaps requires a holistic approach to assess the impact on product quality and consumer safety.

It is clear from the examination of this figure that the total free alkali content varies from 2.6% (Keje soap) to 8.5% (Terminator). It is observed that the total free alkali levels of five (5) soaps (Carimo Métis (4.5%), Keje (2.6%), Carimo Nature (3.89%), Nature Love (4.3%), Pafic (4.1%)) are lower than the value set by the Bureau of Indian standards (BIS). This value must be less than or equal to 5%. On the other hand, the high values of the total free alkali content of the other soaps may reflect incomplete saponification of these different soaps.

Another study shows that free alkali is a parameter that determines the abrasiveness of a soap due to improper or incomplete saponification [18].

The recommended value for free alkali is 2% for toilet soaps by the International Standard Organization (ISO). In summary, free alkali levels in soaps are generally in line with international safety standards for personal care products.

3.7. Assessment of Similarities in the Quality of the Selected Soaps

The assessment of similarities and differences were carried out using a dendrogram for clustering purposes. It is a visual representation of this cluster hierarchy. Hierarchical clustering is a data analysis technique that involves grouping objects into clusters or groups in a hierarchical manner. It is shown in **Figure 1**. From the dendrogram, Keje, pafic, derma delice, nature Claire are similar in overall quality. Terminator and carimo metis are in different clusters. Carimo nature and Bof love are in the same cluster as nature claire and moringa. These results were provided by physicochemical analyses.

4. Conclusion

The aim of the work is to evaluate the quality of some toilet soaps produced in Cameroon. This study highlighted the diversity of the compositions and properties of these soaps. This analysis demonstrated the importance of taking into account the physicochemical characteristics to guarantee the quality and effectiveness of toilet soaps. We note that the pH of the soaps studied are alkaline, which proves that there is a saponification reaction; the total free alkali contents

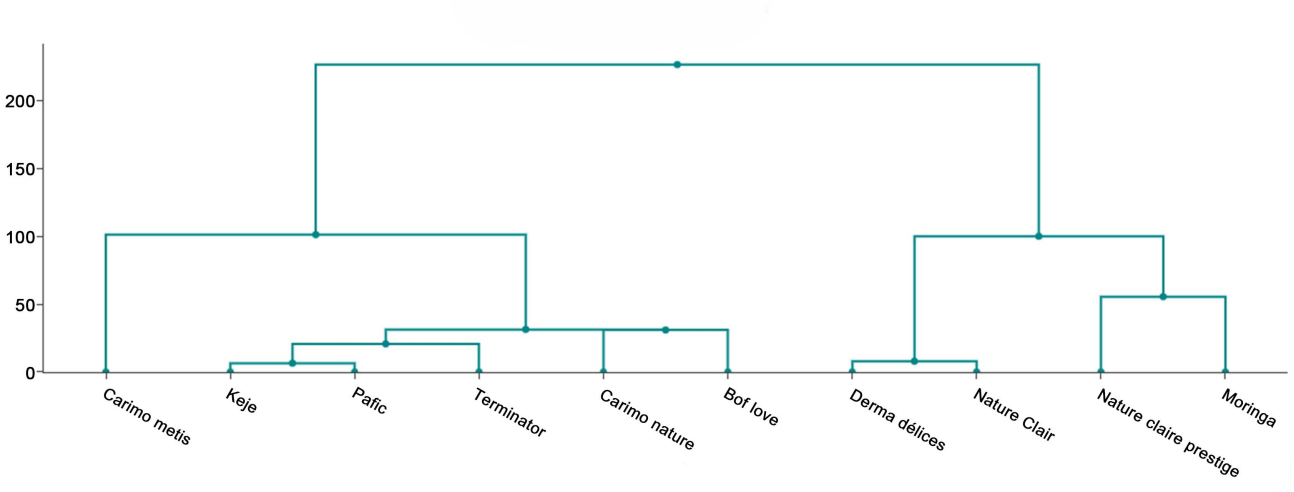

Figure 1. Dendogram showing the different clusters of different soaps.

are acceptable; the water-insoluble matter contents are well above the standard, which means that our soaps contain a lot of impurities. It is essential to continue conducting in-depth studies to improve soap formulations and meet the specific needs of Cameroonian consumers. Because knowledge of physicochemical parameters is a valuable tool for manufacturers to innovate and offer products adapted to the local and international markets.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Mandokhail, F., Jamil, N., Riaz, M., Masood, Z., *et al.* (2015) Study of Physical and Chemical Properties of Local Neem (*Azadirachta indica*) Soap with Branded Soap in Relation to Their Impact on Skin. *American-Eurasian Journal of Toxicological Sciences*, **7**, 239-242.

[2] Idoko, O., Emmanuel, S.A., Salau, A.A. and Obigwa, P.A. (2018) Quality Assessment on Some Soaps Sold in Nigeria. *Nigerian Journal of Technology*, **37**, 1137-1140.

[3] Oyekunle, J.A.O., Ore, O.T., Ogunjumelo, O.H. and Akanni, M.S. (2021) Comparative Chemical Analysis of Indigenous Nigerian Soaps with Conventional Ones. *Heliyon*, **7**, e06689. https://doi.org/10.1016/j.heliyon.2021.e06689

[4] Roila, A., Salmiah, A. and Razmah, G. (2001) Properties of Sodium Soap Derived from Palm Based Dhydroxy Stearic Acid. *Journal of Oil Palm Research*, **1**, 33-38.

[5] Oghome, P., Eke, M.U. and Kamalu, C.I.O. (2012) Characterization of Fatty Acid Used in Soap Manufacturing in Nigeria: Laundry, Toilet, Medicated and Antiseptic Soap. *International Journal of modern Engineering Research*, **2**, 2930-2934.

[6] Benjamin S.E. and Abbass, A. (2019) Effect of Superfating Agents on Soaps Properties. *Journal of oil Palm Research*, **31**, 304-314. https://doi.org/10.21894/jopr.2019.0019

[7] Centre for Affordable Water and Sanitation Technology (CAWST) (2014) Soap Fact Sheet: Soap Making, Calgary, Alberta, Canada.

[8] NC 803 (2013) Norme sur des savons de Toilette. Standards and Quality Agency Cameroon.

[9] Gautam, M. and Acharya, P. (2023) Physico-Chemical Parameterization of Some Commercially Available Toilets and Laundry Soaps in Tansen, Palpa. *Tribhuvan Journal*, **2**, 29-40. https://doi.org/10.3126/tribj.v2i1.60219

[10] Habib, A., Kumar, S., Sorowar, S., Karmoker, J., Khatun, K. and Al-Reza, S.M. (2016) Study on the Physicochemical Properties of Some Commercial Soaps Available in Bangladeshi Market. *International Journal of Advanced Research in Chemical Science*, **3**, 9-12. https://dx.doi.org/10.20431/2349-0403.0306002

[11] Prieto Vidal, N., Adeseun Adigun, O., Pham, T.H., Mumtaz, A., Manful, C., Callahan, G., *et al.* (2018) The Effects of Cold Saponification on the Unsaponified Fatty Acid Composition and Sensory Perception of Commercial Natural Herbal Soaps. *Molecules*, **23**, Article 2356. https://doi.org/10.3390/molecules23092356

[12] Vivian, O.P., Nathan, O., Osano, A., Mesopirr, L. and Omwoyo, W.N. (2014) Assessment of the Physicochemical Properties of Selected Commercial Soaps Manufactured and Sold in Kenya. *Open Journal of Applied Sciences*, **4**, 433-440. https://doi.org/10.4236/ojapps.2014.48040

[13] Popescu, V., Soceanu, A., Dobrinas, S., Stanciu, G. and Epure, D.T. (2011) Quality Control and Evaluation of Certain Properties for Soaps Made in Romania. *Journal of Scientific Study and Research*: *Chemistry and Chemical Engineering*, *Biotechnology*, *Food Industry*, **12**, 257-261.

[14] Mak-Mensah, E. and Firempong, C. (2011) Chemical Characterization of Toilet Soap Prepared from Neem (*Azadirachita indica* A. Juss) Seed Oil. *Asian Journal of Plant Science and Research*, **1**, 1-7.

[15] Azme, S.N.K., Yusoff, N.S.I.M., Chin, L.Y., Mohd, Y., Hamid, R.D., Jalil, M.N., *et al.* (2023) Recycling Waste Cooking Oil into Soap: Knowledge Transfer through Community Service Learning. *Cleaner Waste Systems*, **4**, Article 100084. https://doi.org/10.1016/j.clwas.2023.100084

[16] Isah, A.N., Asli, U.A., Audu, N., Bello, S.I., Waziri, J. and Salihu, S.O. (2021) Laundry Soap Production from the Respective Tallows of Goat, Sheep and Cow: Evaluation of Physicochemical Properties for the Best. *International Research Journal of Pure and Applied Chemistry*, **22**, 22-33. https://doi.org/10.9734/irjpac/2021/v22i330393

[17] Nangbes, J.G., Zukdimma, N.A., Wufem, B.M., Lawam, T.D. and Dawam, N.N. (2014) Quality Survey and Safety of Some Toilet Soaps in the Nigerian Market: A Case Study of B/Ladi, Bokkos and Pankshin, Plateau State. *IOSR Journal of Applied Chemistry*, **7**, 29-35. https://doi.org/10.9790/5736-07732935

[18] Ogunsuyi, H.O. and Akinnawo, C.A. (2012) Quality Assessment of Soaps Produced from Palm Bunch Ash-Derived Alkali and Coconut Oil. *Journal of Applied Sciences and Environmental Management*, **16**, 363-366.