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(RESEARCH ARTICLE)

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Quality evaluation of soaps produced from neem seed oil and shea-butter oil

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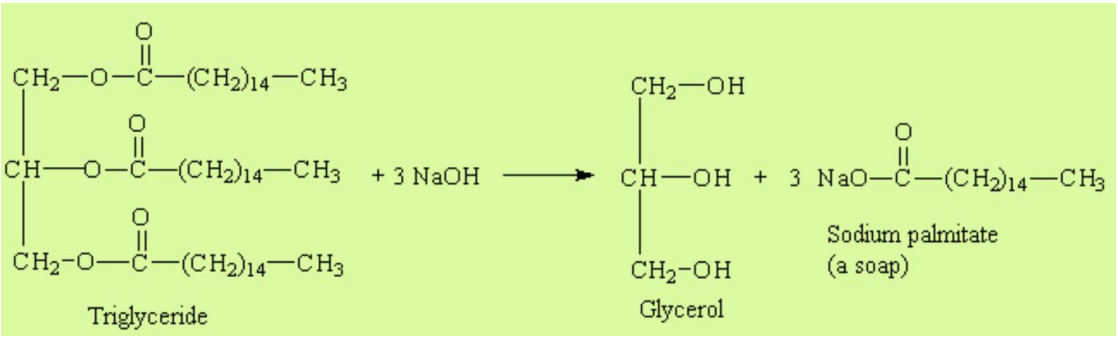
Abstract

Soap is sodium or potassium salt of fatty acid produced by saponification reaction using sodium or potassium hydroxide. It is used for cleaning, bathing, and washing. Soaps were produced from neem seed oil and sheabutter oil using the cold process method with slight modification. The physicochemical properties (acid value, saponification value, peroxide value, iodine value and moisture content) of the oil were determined and it showed that the values are within the standard specifications. The quality of the soaps were also assessed by determining the physicochemical properties such as; free caustic alkali, matter insoluble in alcohol (MIA), pH, total fatty matter (TFM), cleaning properties, washing properties and foam stability. All the results obtained showed that the soaps analyzed are good soaps safe for the skin.

Keywords: Neem Seed Oil; Sheabutter Oil; Physicochemical Properties; Soap

1. Introduction

Soap is sodium or potassium salt of fatty acid produced by saponification reaction using sodium or potassium hydroxide. In ancient Babylon, date back to around 2800BC, soap was prepared by heating animal fat or oil with wood ashes. Wood ashes contain potassium carbonate and sodium carbonate which make the solution basic[17]. The modern commercial method of making soap involves boiling fats or oils in aqueous sodium hydroxide or potassium hydroxide and adding sodium chloride or potassium chloride to precipitate the soaps respectively. The soap is then dried and pressed into bars. Perfumes can be added for scented soaps, dyes can be added for coloured soaps, sand can be added for scouring soaps, and air can be blown into the soaps to make it float[15]. In other words, soap making involves the hydrolysis of triglycerides as shown in Scheme 1.



Scheme 1 Hydrolysis of triglycerides (fat)

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Based on its chemical properties as an anionic surface active agent (surfactant), soap is used to clean and wash skin and clothing [17]. The fatty acids, stearic, palmitic, myristic, lauric and oleic acids, contribute to lathering and washing properties of the soaps [15]. The chemical characteristics of soap depend on several factors: the strength and purity of alkali, the kind of oil used, completeness of saponification and age of the soap. Such chemical characteristics include moisture content, total fatty acids (TFM), pH, free alkali, and percent chloride [4].

Neem oil has been used in the manufacture of natural cosmetics, soap, toothpaste, hair and skin care products, emulsions, liquors, ointments and medicinal cosmetics [3]. However neem oil can be produced mechanically (hot or cold press) or chemically (solvent extraction) from dried neem seeds. The best quality neem oil with a majority of phytoconstituents intact is obtained through cold press. Neem oil contains polysaccharides and limonoids that reduce tumors and cancers eg lymphocytic leukemia and skin cancers. The phenolic compounds containg catechin reduces inflammation, pain and swelling that occur in arthritis. Neem oil combats vaginal infections and sexually transmitted diseases, kills lice [5], scabies, ringworm, athlete's foot fungus and *Phytophthora infestans*, repels mosquitoes, fleas and houseflies when applied to the skin [6] and solves the problem of dandruff, baldness and graying of hair. It cures leprosy, rheumatism, chronic syphilitic sores and indolent ulcer. It clears gonorrhoeae, herpes simplex-2, HIV-1, resistant strains of *E. coli, Staphylococcus aureus*, chicken pox [1], cholera, pneumonia, tuberculosis , peptic ulcer, diabetic foot, dry psoriasis and heals wound and other skin disorders.

Shea butter oil has been used in the manufacture of natural cosmetics, toothpaste, hair and skin care products, emulsions, liquors, ointments and medicinal cosmetics [6]. However, shea butter oil can be produced mechanically (hot or cold process) or chemically (solvent extraction) from the edible nut of the fruit from the Karite tree *(Butyrospermum parkii*) grown in Ghana, Mali, Burkina Faso and other Savannah Grasslands of West Africa [2].

Shea butter oil is rich in essential fatty acids (EFAs), triglycerides, vitamin E and calcium. Because of its EFAs and vitamin E, the oil penetrates deep within the skin to heal the minute cracks brought on by severe dryness. A recent study showed that shea butter has antioxidant properties due to the presence of most important phenolic compounds in shea butter. The phenolic profile is similar to that of green tea, and the total phenolic content of shea butter is comparable to virgin olive oil [2].

2. Material and methods

The moringa oil and neem seed oil were extracted from their respective seeds. The shea-butter oil was purchased from a market in Kwali Area Council, Abuja, while the bleached palm oil was gotten from a crude palm oil obtained from a market in Gwagwalada Area Council, Abuja. The other chemicals used were of Analar grade.

2.1. Bleaching of Oil

In 250ml beaker, 200ml of the oil sample was heated to 1300C, 20g of activated carbon was added while heating the contents of the beaker to 1500C. The mixture was stirred manually during the heating and the mixture was then filtered [10].

2.2. Physicochemical Properties and Analysis

The saponification value, unsaponifiable matter, acid value, iodine value, peroxide value, volatile matter and refractive index were determined using methods described by [13].

2.3. Free Caustic Alkali

Free caustic alkali was determined by the method described by [14]. According to these method 5 grams of finished soap was weighed and dissolved in 30 mL of ethanol. Few drops of phenolphthalein indicator and 10 mL of 20% BaCl2 were added. The resulting solution was then titrated against 0.05M H_2SO_4(aq). The volume of the acid obtained was calculated using equ. 1

$$FCA = \frac{0.31}{W} \times V_A$$

Where; VA is the Volume of acid, W is the Weight of soap and FCA is the Free caustic alkali.

2.4. Matter Insoluble in Alcohol

Five grams of soap sample was dissolved in 50 ml hot ethanol and quantitatively transferred in a pre-weighed filter paper. The residue was dried in the oven at 105˚C for 30 minutes, cooled and weighed again then reading taken. The calculation of matter insoluble in alcohol (MIA) was carried out using equ. 2 [14]

$$MIA = \frac{Ws - FP}{w} \times 100$$

Where: Ws is the Weight of sample + filter paper, FP is the Weight of filter paper and W is the Weight of the sample [12].

2.5. Determination of pH

2 g of soaps were added into 20 ml distilled water and shaken and the soap suspensions were allowed to stay for at least 12 hours before the pH meter was inserted into a beaker containing the various soap suspensions, and the readings were recorded [15].

2.6. Determination of Free Fatty Matter

The total free fatty matter (FFM) was obtained using equ. 3

$$FFM = \frac{100 - (MC - MIA)}{1.085}$$

Where: MC is the Moisture content and MIA is the Matter insoluble in alcohol [15].

2.7. Moisture/Volatile Matter

For the determination of moisture content, 5 grams of samples was accurately weighed using analytical balance of sensitivity 0.1 mg into dried tarred moisture dish in an oven for 2 hrs and temperature of 101˚C and repeated until a constant weight was reached. The % moisture was calculated using equ. 4 [5]

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

Where; CW is the Weight of crucible, CS is the Weight of crucible + sample, and CL is the Weight of crucible + sample after floating [12].

2.8. Washing Properties

A small amount of the dry soap was used to wash the hand using deionized water. The lathering properties and the “feel” of the soap was taken (very slippery, greasy, or about normal).

2.9. Foam Stability

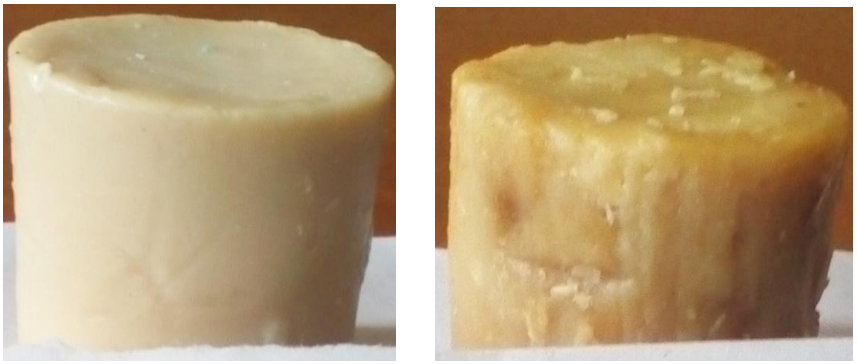
1% of the soap samples were prepared and equal amount of the soap solution was measured into test tubes. The solution was shaken vigorously for 1 min and allowed to stand for five minutes. The height of the foam was observed and recorded.

2.10. Cleaning Properties

A drop of used oil was placed on strips of filter paper. The strips was placed into test tubes containing the 1% soap solutions. The soap solutions was then shaken vigorously and allowed to stay for 2 mins. The filter paper was removed and rinsed with water. The cleansing power was observed and recorded.

2.11. Soap Preparation (cold process)

The soaps were produced using method described by Idoko. The appropriate amount of the oils were weighed and melted and mixed with 20% of NaOH in a beaker. After stirring for 30 mins, it was poured into a mould and allowed to cure. It was removed from the mould after solidifying.



Shea (a) **Neem (b)**

Figure 1 (a) Sheabutter soap; (b)Neem oil soap

3. Results and discussion

Table 1 Physicochemical Properties of neem and shea-butter oils

Oils Samples	SAP. V. mgKOH/g	IODINE V. WIJS	PEROXIDE V. meq/kg	ACID V. mgKOH/g	M. C. %
Neem	200.45	72.53	2.50	8.95	0.05
Shea	175.42	40.82	2.90	5.01	1.02
CODEX	-	-	10-15 max	8.0	0.2

Table 2 Physicochemical properties of the soap samples

Soap samples	pH	Free Alkali %	MIA %	TFM %	Moisture content %
Neem	10.03	NIL	19	73.00	8.00
Shea	9.93	0.2	61	28.83	10.17
Standard specifications	7 – 10[17]	2 – 5% [14]	70 Max [34]	50-100% [16]	10-14%[11-12].

Table 3 Other physical parameters of the soaps samples

Soap samples	Cleaning properties	Washing properties	Foam stability
Neem	Very good	Normal	Very stable
Shea	Good	Normal	Stable

The physicochemical properties of the oils were presented in Table 1. The saponification values of the oils ranged between 175.42 – 206.55 mgKOH/g. The high saponification values is an indication that the oils are good for soap

making [9]. The iodine value of the neem and sheabutter oils are 75.53 wijs and 40.82wijs respectively. This is an indication that the neem oil is more unsaturated and will remain solid at room temperature than the sheabutter oil. The peroxide value of the oils ranged between 2.50 – 2.90 meq/kg. The values showed that the oils are not rancid [19]. The acid value of the neem oil is higher than that of sheabutter, though slightly above the Codex standard value [19]. The moisture content of the sheabutter is higher than the standard, but that of the neem oil is within the standard.

The physicochemical properties of the oils were presented in Table 2. The pH values of the soaps showed that they are within the standard pH specification for a good soap[8]. The free caustic alkali for the neem oil soap is negligible while that of is very low compared to the standard. This showed that the soaps will not be harsh to the skin or cloth [15]. The matter insoluble ethanol MIA, is a parameter that determines the level of purity of any given soap [12].. The MIA value for neem oil soap is very low compared to the value for sheabutter, this is an indication that the neem oil soap is of higher quality than the the sheabutter soap [2]. The total fatty matter TFM, is the total amount of fatty matter that can be separated from a sample after splitting with mineral acid[9]. The TFM for neem oil soap is 73% while that of sheabutter is 28.83%. The value for the neem oil soap fall within the standard specification range of 50 – 100%. The moisture content of the soaps fall within the specified standard, that is, the soaps will have longer shelf life.

The other physical properties are presented in Table 3. The cleaning properties, washing properties and foaming stability of all the soaps showed that the soaps wash and cleanse well, it also have a stable foamabilty.

4. Conclusion

In this work, soaps were produced from neem and sheabutter oils. The soaps are skin friendly and have good cleansing, washing and lathering properties.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest. Only one author is involved

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