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Chemical characterization of local black Soap (Chahul Mtse) made by using cassava peels ashes (alkali base) and palm oil in North Central Zone of Nigeria

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ABSTRACT

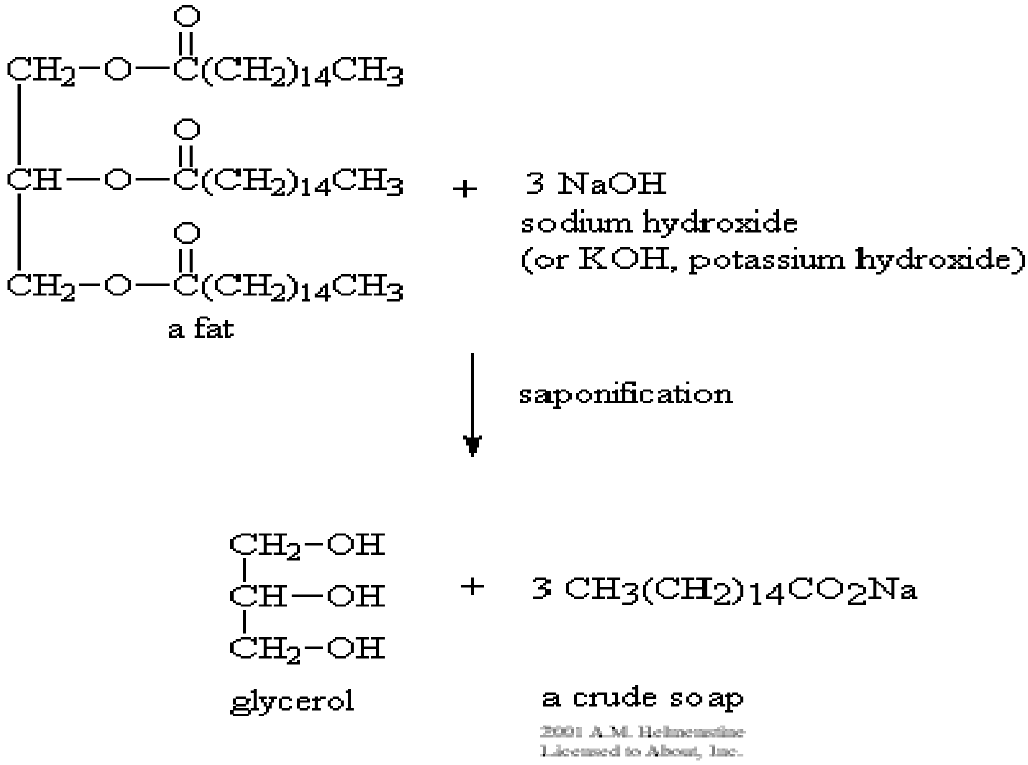
Chemical characterization of local black by using cassava peels ashes (alkali base) and palm oil in North Central Zone of Nigeria is essensially crude soap made by using cassava peels ashes (alkali base) and palm oil . These peels were burnt to ashes and the alkali extracted from it by dissolving in water and later filtered. This Soap(Chahul Mtse) made extract is made to react with hot oil and the resultant mixture is black soap. This soap is often disregarded due to its color and mode of preparation .The values for total fatty matter (TFM), total free alkali (TFA), free carbonate alkali (FCaA), free caustic alkali (FCA), pH, lather volume and foam analysis were 62% (w/w), 6.7% (w/w), 3.8% (w/w), 2.95% (w/w), 9.0, 300ml and 6.33 hrs respectively while the wash-active-substance was found to be 35.78% compared to the modern soap. The chemical characterization however has revealed this soap has a quality very close to any standard soap These results showed the potency as well as the inadequacies of black soap which can be improved upon **.**

Key words- , analysis crude, cleansing, , domestic surfactant.

1 . Introduction

Soap is a substance that dissolves in water to remove dirt form surfaces such as skin ,textiles and other solids. Soaps are mainly used as surfactants for washing, bathing, and cleaning, but they are also used in textile spinning and are important components of lubricants. Soaps for cleansing are obtained by treating vegetable or animal oils and fats with a strongly alkaline solution. Fats and oils are composed of triglycerides; three molecules of fatty acids are attached to a single molecule of glycerol. Cavitch, Susan Miller. (1994) The alkaline solution, which is often called lye (although the term "lye soap" refers almost exclusively to soaps made with sodium hydroxide), brings about a chemical reaction known as saponification.

at + Lye → Soap + Glycerol



In saponification, the fats are first hydrolyzed into free fatty acids, which then combine with the alkali to form crude soap. Glycerol (glycerine) is liberated and is either left in or washed out and recovered as a useful byproduct, depending on the process employed .Soap could also be used as medicine germicides and other medical ingredient are added and is used as germicides, bactericides etc.

However, some soap cause problems to users, some bleach while some have inefficient foam forming , that is, the time taken for the given volume of foam to subside is shorter than anticipated said to b e inefficient foaming. It is also noticed that hard water reacts with soap to form a scum and makes the soap not to foam.

2 . Aims and Objectives

This work is aimed at preparing local crude soap using ashes from cassava peels and palm oil

The final product shall be analyzed, and the quality compared with the standard soap.

Identify any lapses in the products and areas of improvement.

Acronyms used and their meaning.

Total Free Alkali	**-**	**TFA**
Free Caustic Alkali	**-**	**FCA**

Total Fatty Matter	**-**	**TFM**
Lather Volume	**-**	**LV**
Wash-Active-Substance	**-**	**WAS**
Foaming Efficiency	**-**	**FE**
Free Carbonate Alkali		**FCaA**

3 . MATERIALS AND METHODS

Soap making is very versatile because of its wide demand and so are the methods. In choosing the materials and methods in this work, consideration is made of various methods already carried out in research. E.G. Olumayede and B.F. Adeosun (2008) R.N. Shreve, . (1967)

3.1 Materials and /Reagents

Ash(cassava peels) , palm oil , white cloth,, cassava starch distilled water methy1-orange indicator Diethy1 ether 0.1m Sulphuric Acid Anhydrous sodium sulphate 96% ethanol Phenolphthalein indicator Barium chloride Filter papers .

3.2 Preparation of the Ash Sample

Cassava peels were sun-dried for two weeks. The dried peels where burnt to ashes. The incompletely burnt materials were removed and burnt again. The ash sample was allowed to cool and packed in a polyethylene bag.

3.3 Preparation of Local Black Soap

To 100g of the ash sample was added 200ml of warm water. After stirring for 30 minute, the mixture was filtered with clean white cloth to obtain the alkali extract (pH = 9.0).

The extract (100ml) was gradually added to 250ml breaker containing 40g of thoroughly heated palm oil. The mixture was heated with stirring into the hot soap solution. The mixture was allowed to cool into a solid mass, which was collected as black soap

3. 4 Analysis of Soap Sample

3.4. 1 Total Fatty Matter (TFM)

The soap sample (weight = 5g) was dissolved in 50ml-distilled water and the volume adjusted to 10ml. to 10ml. the solution was allowed to cool and then made acidic with 0.1m sulphric acid. The solution is then extracted with 50ml diethy1 ether and then with another three-25ml portions of diethyl ether.

The combined ether extracts was filtered into a tarred 250ml flask and the ether evaporated. The weight of the total fatty matter is obtained by subtracting the weight of the ether extracts form initial weight of the soap sample.

3. 4. 2 Total Free Alkali (TFA)

10g of soap sample were digested in freshly boiled ethanol (200ml) on steam bath until the soap sample was dissolved. The solution was heated to boiling and then filtered with standard 0.1m sulphuric acid to phenolphthalein and point.

The total free alkali is calculated as potassium oxide using the relationship weight (g) of TFA = molarity of acid formula weight of oxide X volume of acid used (liters).

3.4. 3 Free Caustic Alkali (FCA)

10g of soap were dissolved in 100ml of neutralized ethanol over steam bath and 10ml of barium chloride added to the hot solution. The soap sample is filtrated with0.1m sulphuric acid using phenolphthalein indicator. The amount of free caustic alkali in the soap is calculated using the relationship as;

FCA = molarity of acid X formula weight of barium chloride X volume of acid used (liters).

3.4 .4. Free Carbonate Alkali

Free carbonate is determined by subtracting the free caustic alkali from total free alkali that is,

Free carbonate alkali = TFA-FCA

3.4 .5 Wash-Active-Substance (WAS)

50g of the soap sample was digested in freshly boiled ethanol (300ml). The solution was refluxed for 75 minutes over steam bath and then allowed to settle down. 1% ethanol phenolphthalein (2-4 drops) was added. The solution was filtered and the resulting precipitate was washed with ethanol (50ml) into the flask and then boiled and filtered as before into the flask containing the filtrates. The washings were repeated five times. The combined filtrates were evaporated to dryness over the steam bath and residue was dried in an oven at 105 ^{o}c constant weight. The paste obtained is the W.A.S.

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Results and Discussion .

Table 1: Total Fatty Matter

Number of experiment	**1st**	**2nd**	**3rd**
Weight Of Beaker + Ether Extract (g)	77.70	76.60	77.00
Weight Of Beaker In Grams	76.00	74.90	74.80
Weight Of Ether Extract In Grams	1.70	1.70	2.20

Average weight of ether extracts $= \frac{1.70+1.70+2.20}{3}$

$= \frac{5.60}{3} = 1.867g \quad = 1.90g$

Total fatty matter= initial weight of soap sample

Minus 1.90

= 5.0g-1.9g

= 3.10g

Therefore if 5.0g sample gave 3.10g TFM

100g sample will give Xg

$\frac{3.10}{5.0} \quad x \quad 100$

=62.0% (w/w)

Table 2 **Total Free Alkali (TFA)**

Number of reading	**1st**	**2nd**	**3rd**
Final Burette reading (cm^3)	80.30	74.00	80.00
Initial burette reading (cm^3)	10.00	0.00	10.00
Volume of acid used (cm^3)	70.30	74.00	70.00

Average volume of acid used $= \frac{70.30 + 74.00.70.00}{3}$

$= \frac{214.3}{3}$ $71.40cm^3$

1 liters is equivalent to 1000cm3

X liter will be equivalent to 71.40cm3

$= \frac{71.40}{1000}$ = 0.0714 liters

According to Stillman (1973) TFA was calculated as potassium oxide (KOH) using the relationship.

Weight of TFA (g) = molar concentration of acid X

Formula weight of potassium oxide

X volume of acid used (liters)

KOH = 94.00gmo-^{1}, concentration of acid = 0.1m

Weight of TFA = o.1x94.0x0.0714

= 0.67116

= 0.64g

10g of soap sample gave 0.67g of TFA

100g will be = $\frac{0.67 \times 100}{10}$

= 6.7%

Table 3: Free Caustic Alkali (FCA)

Number of readings	1st	2nd	3rd
Final Burette Reading (cm^3)	33.0	30.00	31.70
Initial Burette Reading (cm^3)	0.00	0.00	0.00
Volume OF ACID (cm^3)	33.00	30.00	31.20

Average volume of acid used $= \frac{33.00+30.00+31.20}{3}$

$= \frac{94.2}{3}$ $= 31.4cm^3$

If 1 liter is equivalent to $100cm^3$

X liter will be equivalent to $31\ .3cm^3$

$= \frac{31.30 \times 1 \text{ liter}}{1000}$

= 0.0314 liters

Free caustic alkali is calculated as in table 2.

That is, weight of FCA (g) = 0.1 x94 x 0.0314

= 0.295g

10g of soap sample gave 0.295g of FCA

100g will give $\frac{0.295 \times 100}{10}$

2.95% (w/w)

Free carbonate alkali (FCA) = TFA – FCA

= 6.7% -2.95%

= 3.75% (w/w)

Table 4 : Time and Foaming Efficiency - f.E

Number of readings	1st	2nd	3rd
Volume of lather formed **(cm^3)**	300	320	340
Time taken to subside	6.20hrs	6.40hrs	6.40hrs

Average volume of lather formed = $\frac{300 + 320 + 340}{3}$

= $320cm^3$

Average time taken for the foam to subside

= $\frac{6.20 + 6.40 + 6.40}{3}$

= $\frac{19.0}{3}$ = 6.33hrs

Table 5 : Wash – Active = Substance – W.A.S

Number of readings	**1st**	**2nd**	**3rd**
Weight of flask/precipitate (g)	83.16	83.17	83.16
Weight of flask (g)	51.00	51.17	51.00
Weight of precipitate (g)	32.16	32.00	32.16

Average weight of precipitate $= \frac{32.16 + 32.00 + 32.16}{3}$

$= \frac{96.32}{3} = 32.11g$

W.A.S (g) = initial weight of soap sample – 32. 11g

50g – 32.11

= 17.89g

Thus 50g of soap gave 17.89g of W.A.S

100g will give $\frac{17.89 \times 100}{50}$

= 35.78%

pH

Number of readings	1st	2nd	3rd
ph	8.99	9.07	8.99

The mean $= \frac{8.99 + 9.07 + 8.99}{3}$

$= \frac{27.05}{3} = 9.02$

pH= 9.0

The table 5 below summarizes the results obtained form the chemical analysis of the local black soap.

Table 6: Product Analysis of Black soap

Parameters	% composition
Total fatty matter	62%
Total free alkali	6.7%
Free caustic alkali	2.95%
Free carbonate alkali	3.8%
Lather volume (ml)	330
Time for lather to subside	6.33hrs
W.A.S	35.78%
pH	9.0

Table 7. Chemical characteristics of the prepared neem soap, compared with a toilet soap brought from Kumasi Central Market as control E. E. Mak-Mensah *et al (2011)*

Characteristics Neem soap Control

% Total fatty matter 63.75 ± 0.07 67.01± 0.04

% Total alkali 0.24 ± 0.01 0.20 ± 0.01

% Free caustic alkali 0.06 ± 0.002 0.06 ±0.003

% Chloride 1.15 ± 0.02 1.20 ± 0.02

% Moisture 12.63 ± 0.04 12.42 ±0.01

pH 10.4 ± 0.04 10.1 ± 0.02

Table 8 Differences between toilet soap standards and black soap

Parameters	Black soap	Standard toilet soap (Lux)	Remarks
Total fatty matter %	62	65	Different oils
Total free alkali %	6.7	4.6	High pH
Free caustic alkali %	2.95	4.6	High basic content
Free carbonate alkali %	3.8	1.3	Multiple carbonates in ashes
Lather volume (ml)	330	330	Similar
Time for lather to subside hrs	6.33	Similar	Similar
W.A.S %	35.78	Similar	Similar
pH	9.0	Similar	Similar

5.0 Conclusion

The data on black soap shows that it can compete favorably with other toilet soaps. The apparent deviation is due to its crude nature and that of raw materials. The colour black may probably be improved by a thorough bleaching of the oil used for saponification process; colorant may also be used to give desired colour to be the soap. Foaming efficiency can be taken care of by addition of water softeners and scum dispersant, this addition plays an important role in lowering the surface tension of the water.

6.0 Recommendations

The crude soap obtained from the saponification reaction contains sodium chloride, sodium hydroxide, and glycerol. These impurities are responsible for some of the differences seen in black soap. They can be removed by boiling the crude soap curds in water and re-precipitating the soap with salt. After the purification process is repeated several times, the soap may be used as an inexpensive industrial cleanser. Sand or pumice may be added to produce a scouring soap. Helmenstine (2012) The raw materials and the processing of black soap have left so much room for manufacturers to explore and satisfy the tastes of soap users , create more jobs as well as make profits and further investments.

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