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ASSESSMENT OF THE QUALITY OF SELECTED SOAPS SOLD IN KATSINA METROPOLIS, KATSINA STATE, NIGERIA

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ABSTRACT

The Katsina central market in Nigeria's Katsina State is where sixteen soaps were purchased. The following physicochemical parameters were used to evaluate the soaps: pH, Total fatty matter (TFM), M&V, Alcohol insoluble (AI), Free alkali (FA), and Alcohol insoluble (AI). Typically, the following soap samples fail the tests: TFM 25%, AI 75%, FA 50%, pH 50%, M&V 100% for laundry soaps; TFM 50%, AI 100%, FA 75%, pH 50%, M&V 100% for toilet soaps; and TFM 25%, AI 75%, FA 75%, pH 0%, and M&V 75% for medicated soaps. According to the chemical analysis of this study, 61% of the laundry, toilet, and medicated soaps offered in Katsina metropolis are subpar, counterfeit, and not real, based on the Standard Organization of Nigeria (SON) recommended values. The conclusion is that while many soaps are of poor quality, only a small number of them are genuine, which could be harmful to people's health. The relevant authorities must impose tight regulations to guarantee the manufacturing of high-quality, consumer-safe soaps.

Keywords: Soap, Medicated, Laundry, Toilets, Quality

INTRODUCTION

An emulsifying or cleaning agent called soap is created by reacting vegetable or animal fats or oils with potassium or sodium hydroxide. The process of generating soap (saponification) involves the hydrolysis of triglycerides by a base (often NaOH or KOH) to produce three salts (soap) and glycerol. Depending on the base utilized, the molecules crystallize in various ways. KOH is usually used to make liquid soaps, while NaOH generates a tougher bar (Mohammed and Usman, 2018).

Oil + 3NaOH = Glycerol + 3 Soap (Mohammed and Usman, 2018)

A chemical molecule known as fatty acid is the source of soap. A long hydrocarbon chain called a soap molecule has a carboxylic acid group at one end that is bonded to a metal ion, typically sodium or potassium, through an ionic bond. The ionic end is soluble in water, but the hydrocarbon end is non-polar and highly soluble in non-polar substances. The ability of soaps to emulsify or distribute water-insoluble compounds and keep them in the suspension of water is what gives them their cleaning properties (Mohammed and Usman, 2018).

Chemically speaking, soap is an alkali metal salt of long - chain monocarboxylic acids and is used as a cleaning agent. Chemically speaking, soap is denoted by the formula CH_3COONa, where R- denotes the hydrocarbon chain and is hydrophobic, while CH_3COONa denotes the polar group and is hydrophilic. Useful soaps have hydrophilic carbon chains of 12 to 18 for detergency. The soap cannot remove oil if it has less than 12 hydrophobic carbon atoms, and it can operate as a detergent if it has more than 18 hydrophilic carbon atoms. The soap is a detergent but detergent has been used loosely to refer to only synthetic detergent (Abubakar and Anih, 2012).

Everyone is familiar with the basic cleaning product known as soap. Any cleaning agent produced as granules, bars, flakes, or liquid is referred to as soap. Soap is made by reacting salts of sodium or potassium with different fatty acids that have naturally occurred in the body (salt of non-volatile fatty acids). Any water-soluble salt of fatty acids with eight or more carbon atoms is referred to as soap. Soaps are made for many different purposes, such as cleaning, bathing, and administering medication. The cleansing action of the soap is due to the negative ions on the hydrocarbon chain attached to the carboxylic group of the fatty acids.

The primary reason soap is used mostly with water for cleaning reasons is because the hydrocarbon chain has an affinity for oil and grease while the carboxylic group has an affinity for water (Zauro et al. 2016). The process of manufacturing soap and the quality of the soap are both influenced by factors. These variables include the caustic soda-lye content, the oil quality, and the amount of water required in its production. The amount of free fatty acids in the oil, how hot the components are before mixing, and how violently you mix will all affect how quickly the oil reacts with the caustic soda.

The following soap-making process is accelerated by heat, rapid mixing, and free fatty acid concentrations. The caliber and cleansing power of soaps is determined by their physicochemical composition. A few examples of these physiochemical traits are pH, total fatty matter, free caustic alkali, moisture content, and free fatty acid. The characteristics of the alkali and oil used, together with completing complete saponification, also significantly affect the quality of the soap (Mohammed and Usman, 2018). Therefore, the current study is aimed at evaluating the quality of selected soap brands sold in Katsina metropolis.

MATERIAL AND METHODS

Sample Collection

The antiseptic, antibacterial, laundry, and toilet soaps were obtained from Katsina Central Market, Katsina State, Nigeria. All the samples were aseptically transported to the laboratory for analysis (Ogunsuyi and Akinnawo, 2012).

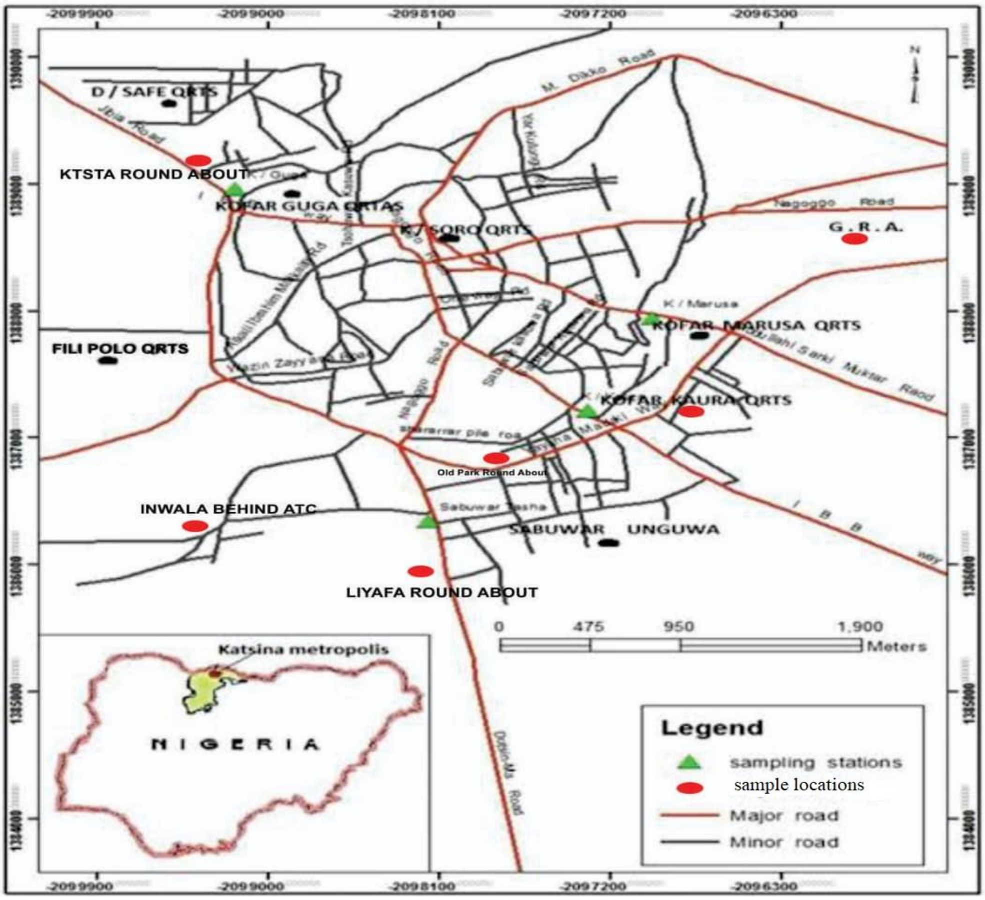

Figure 1: Map of Katsina State Showing the Sampling Points

Sample Processing

All the samples obtained were in solid form and the reagents used were of analytical grades and were not further purified.

Methods

Determination of Total Fatty Matter

i. Accurately weighed 5.0g of soap and transferred into 250 ml beaker.
ii. To completely dissolve the soap 100 ml hot water was added.
iii. The mixture was heated over a hot plate until the fatty acids were floating as a layer above the solution.
iv. Then the mixture is cooled suddenly in ice water to solidify the fatty acids and separate them.
v. 10cm^{3}of 10% H_2SO_4 was added to the mixture.
vi. 100cm^{3}of neutralized alcohol was added to components of the mixture rather than oil.
vii. 100cmof Diethyl Ether was added to dissolve the oil.
viii. The solution is shaken and allowed to separate into 2 layers and the bottom layer was drained out.
ix. 75cm^3 of Diethyl Ether was added to the remaining solution in the separating funnel.
x. The fatty acid dissolved in Diethyl Ether is again separated as in the previous case and it is transferred to the collected fatty matter.

The same procedure was carried out for 50 cm^3 of Diethyl Ether

From the difference in weight, the % of the fatty matter was calculated in the given soap sample:

TFM = (a-b)/c x 100

Where;

a- Weight of Conical flask
b- Weight of Conical flask
c- Initial weight of soap taken

Determination of Alcohol Insoluble Matter

Five (5) g of soap samples were dissolved in 50 mL hot alcohol and quantitatively transferred in a pre-weighed filter paper. The residue was dried in the oven at 105 °C for 30 min, cooled in the desiccator and weighed again.

Determination of Free Alkaline

A sample of the scrapped soap (10 g) was placed in a conical flask and

i. 100 cm^3 of neutralized alcohol was added.
ii. The flask and the content therein were placed in a water bath and heated until the soap dissolved.
iii. The 10 cm^3 of 10% Barium chloride solution was added
iv. 2 to 3 drops of phenolphthalein indicator were added.
v. The whole content was titrated against O.1N H_2SO_4 until the solution became colorless (12).

The free alkali as NaOH was then calculated by;

FA= (B-S) N x 5.3

Where,

B- Volume in ml of standard HCl used for the blank
S- Volume in ml of standard HCl used for the sample
N- Normality of standard HCl used

Determination of Moisture Content

Moisture content was determined by drying 10g of the sample to a constant weight at 105 ºC according to AOAC (2000). It was allowed to cool and then reweighed. The moisture content was determined from the following formula:

Moisture content = (Cs - Ch / Cs - Cw) × 100
Where; Cw= weight of the crucible
Cs=weight of crucible + sample
Ch = weight of crucible + sample after heating

Determination of pH

The pH value was determined using pH meter (Jenway 3505). 10g of the soap shavings was weighed and dissolved in distilled water in a 100 cm^3 volumetric flask (10% soap solution). The pH reading was recorded for every soap.

Determination of Hardness (Penetration Value)

A hardness test on the soap was done by piercing a needle through the surface of the soap. The distance at which the needle pierced through the bar of soap determined its hardness. Generally, hard soaps penetrate less while soft soaps penetrate more. The more the penetration the softer the soap and vice versa.

RESULTS AND DISCUSSION

Results

The tables below describe the mean and standard deviation values of laundry, toilet, and medicated soaps with their respective standard organization of Nigeria reference values. Physicochemical characterizations of the various soaps were carried out which include; TFM, AI, FA, pH., M&V, and PV.

Table 1: Mean & Standard Deviation Values for Laundry Soap

SAMPLE	TFM	AI	FA	pH	M&V	PV
A	58.46 ±0.50	16.21±0.25	0.19±0.03	9.48±0.1	20.36±0.25	18.5±0.58
B	71.90 ±0.35	0.88 ±0.02	0.06 ±0.01	8.0 ±0.08	16.22±0.36	18.0±0.82
C	45.38±0.28	29.20±0.24	0.17±0.01	9.3±0.08	19.80±0.28	18.75±0.5
D	57.15±0.15	18.0±0.11	0.06±0.01	8±0.08	16.22±0.36	18±0.82
SON	50-65	15.6	0.1	6.5-8.5	25.0	

KEY; A=WAW, B=VIVA +, C=NITTOL, D=SUBAN TFM=Total Fatty Matter, AI=Alkaline Insoluble, FA= Free Alkaline, M&V=Moisture & Volatile Matter

Table 2: Mean & Standard Deviation Values for Toilet Soap

SAMPLE	TFM	AI	FA	pH	M&V	PV
E	75.36±0.52	0.86±0.10	0.02±0.01	7.33±0.1	11.96±0.18	8±0.81
F	54.13±0.31	34.33±0.45	0.16±0.01	9.01±0.1	5.22±0.15	4.5±0.58
G	63.57±0.29	22±0.11	0.04±0.01	6.63±0.05	7.4±0.29	6±0.0
H	70.35±0.44	8±0.16	0.14±0.01	9.5±0.12	12.22±0.20	10±0.0
SON	70-76	3.0	0.1	6.5-8.5	13.0	

KEY; D= LUX, F=HALA, G=FRESHGLOW, H=PREMEIR TFM=Total Fatty Matter, AI=Alkaline Insoluble, FA= Free Alkaline, M&V=Moisture & Volatile Matter

Table 3: Mean & Standard Deviation Values for Medicated Soap

SAMPLE	TFM	AI	FA	pH	M&V	PV
I	73.13±0.55	3.3±0.08	0.07±0.01	8±0.08	6.53±0.22	5.13±0.25
J	77.38±0.24	5.43±0.10	0.02±0.01	7.61±0.03	6.87±0.09	4.88±0.25
K	70.30±0.18	16.51±0.07	0.18±0.01	7.76±0.05	4.24±0.08	3±0.0
L	70.41±0.38	7.51±0.32	0.19±0.01	6.69±0.05	5.55±0.10	4.38±0.54
SON	70-76	3.0	0.05	6.5-8.5	5.0	

KEY; I=BLACK SEPTOL, J=SANITOL, K=DETTOL EVENTONE, L= 2SURE TFM=Total Fatty Matter, AI=Alkaline Insoluble, FA= Free Alkaline, M&V=Moisture & Volatile Matter

Discussion

Tables 1, 2, and 3 show the finding of the qualitative analysis of a sample of soaps conducted in this study using several parameters, including total fatty matter (TFM), alkaline insoluble (AI), free alcohol (FA), pH, penetration value, moisture content, and volatile content.

According to Table 3.1's findings, some of the mean and standard deviation values for TFM, AI, FA, and pH are below the SON reference values and others are above them. All of the M&V values seemed to be within the SON reference range. This coincides with the work of
(Ogunsuyi and Akinnawo, 2012) who reported the physicochemical properties of some soaps as; TFM (55.45), AI (3.5), M&V (9.53), and FA (0.09). The result also agrees with the report of (Popescu *et al.* 2011) who indicated the values of the physicochemical parameters of soaps as; pH (7.3), M&V (10.4), TFM (34), FA (0.56), and AI (20).

In Table 3.2, TFM and FA are within and below, while AI falls below and above and pH too are within and above the SON's reference values of the various soaps analyzed. The report of (Popescu *et al.* 2011) indicated a pH range of (5.5 – 8.0), moisture (10 – 16.2), TFM (71 - 84), AI (20 - 28), and FA (0.13 – 0.16).

As indicated in Table 3.3, the medicated soaps analysed shows a range of values as; TFM (70.3-77.38,), AI (3.3-16.51), FA (0.02-0.19), pH (6.69-8.0) and M&V (4.24-6.87). All the outcomes of the analysis indicated that some are below, within, and above the SON reference values. This corresponds with the work of (Popescu *et al.* 2011) who reported medicated soap physicochemical properties range values as pH (6.5-7.3), M&V (10.4-14.0), TFM (34-65), FA (0.56-0.88) and AI (20-23).

High moisture content in soap implies that the excess water could possibly react with any unsaponified neutral fat to give free fatty acid and glycerol in a process called hydrolysis of soap on storage. Moisture content is a parameter that is used in assessing the shelf–life of a product (Tewari 2004). The alkaline nature of soap is to serve as a barrier against abnormal bacterial flora and viruses by neutralizing the body's protective acid nature (5.4-5.9) for a healthy body and makes it lather easily. Additionally, soap with pH below 5 and above 10 causes harshness on the hands and skin (Isah *et al.* 2021). Good quality soaps according to (Isah *et al.* 2021) should have TFM values above 76%, although 60% is considered the lowest acceptable percentage and guarantee safe usage of soaps made from selected tallows. Free caustic alkali is one of the parameters that determine the abrasiveness of any given soap. Based on the outcome of this study, some (FA) values fall within while others above the SONs recommended values, this may be attributed to the property of the oil used in the soap production which determines the rate at which the oil saponified (Ogunsuyi and Akinnawo 2012). The alcohol insoluble (AI) is a parameter that determines the purity of soap. According to (Idoko *et al.* 2018), a high level of impurities in soaps may be attributed to the level of impurities of alkali and fat/oil used for producing the soap.

CONCLUSION

Generally, the soap samples that fail the tests include; laundry soaps: TFM 25%, AI 75%, FA 50%, pH 50%, M&V 100%; Toilet soaps: TFM 50%, AI 100%, FA 75%, pH 50%, M&V 100%, and Medicated soaps: TFM 25%, AI 75%, FA 75%, pH 0%, and M&V 75% respectively. From the chemical analysis of this study, 61% of laundry, toilet and medicated soaps sold in the Katsina metropolis are sub-standard, fake, and not genuine, based on SON recommended values. The implication is that few of the soaps are of good quality while many are not which might be detrimental to the health of individuals. There is a compelling need for appropriate authorities to enforce strict policies that will ensure the production of good and safe quality soaps for consumers.

RECOMMENDATION

Appropriate authorities should provide and enforce strict industrial policies that will evaluate and monitor quality of soaps produced before marketing the product.

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