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Quality Assessment Of Physicochemical Properties Of Palm Oil From Different Palm Oil Mills In Isoko, Delta State

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Abstract: ***Palm oil is the most commonly used vegetable oil in Nigeria due to its numerous benefits. Therefore, it is very important to assess the quality and physiochemical properties of palm oil. In this study, oil samples were collected from different oil mills in Isoko North and Isoko South L.G.A of Delta. Physical and chemical properties of the oil samples were evaluated using standard procedures. Physicochemical parameters such as; free fatty acid value, peroxide value, relative density and pH values, saponification value, ester value and moisture content were also determined using standard protocols. The result showed that the moisture content ranged from 0.26% to 0.86%, relative density ranged from 0.8746 g/ml to 0.9447 g/ml the saponification value ranges from 192.49± 1.47 to 202.73 ±0.09 (SV), Free fatty acid and Acid value ranged from 15.60% to 16.90%, ester value ranges from 160.86±6.35 to172.86±1.49 and peroxide value ranges from 18.8124meg/kg to 18.9068meg/kg respectively. All samples showed 35% SV suggesting the palm oil will be good in soap production. It is recommended that oil palm factories in Imo state processing and storage method should be properly monitored to prevent major contamination or adulteration which might have an adverse effect on the future of oil palm industry in Imo state, Nigeria.***

Keywords: Physiochemical, Isoko, Palm oil, Assessment

I. INTRODUCTION

Palm oil is the most commonly used vegetable oil in Nigeria; it is orange-red to brownish or yellowish-red in colour. The palm fruit, a tropical tree crop takes five to six month to mature from pollination and it is mainly grown for its industrial production of vegetable oil (Ekwenye, 2016)

It is cultivated over large uniform areas close to central oil mill to enable rapid industrial handling or processing after harvesting. After processing the palm fruit, oil is extracted from both the pulp of the fruit and the kernel (Agbaire et al, 2012).

The oil palm grows up to 9m (30ft) in height. It has a crown of feathery leaves that are up to 5m (15ft) long. The flower clusters is on a short thick spike at the base of the leaves. Flowering is followed by the development of a cluster of egg shaped, red, orange or yellowish fruits. Each fruit is approximately 3cm (1inch) long and contains from one to three seeds embedded in a reddish pulp. Palm oil is derived from the mesocarp of the fruits of West African oil palm (Elaeis guineensis) or of E. Oleifera and E.odora which are natives of South America. The extracted oil contains a considerable proportion of water as well as soil, fibre and debris Palm oils rich content of saturated and monounsaturated fatty acids has actually been turned into an asset in view of current dietary recommendations. The use of palm oil in combination with other oils and fats facilitates development of a new generation of fat products that can be tailored to meet most current dietary recommendations (Sundram, 2003).

Oil extracted usually reaches only 25% of the available oil in the fruit.

However, the different methods used in some local mills in Imo state, Nigeria leads to production of oil of different qualities. This practice may reduce the quality of the extracted palm oil. Therefore, the need to assess the quality of palm oil from different palm oil local factories in Imo state is of great

importance as most people utilizes the palm oil direct without any further purification (Okechalu et al., 2011

The result obtained from the research shows that all parameters analyzed were within limit except for moisture 0.32 % and the free fatty acid after the required day (tenth-day). However, the study concluded that the palm oil is of good quality. The scope of this work is to determine the physical and chemical properties of palm oil samples obtained from different local oil palm processing mils within Isoko North and Isoko South L.G.A of Delta state. In the present study, the physical and chemical properties determined includes the Peroxide value, Relative density, free fatty acid, saponification value, ester value, moisture content and pH value. The information obtained from this research work will be very important to food processors, palm oil consumers within the LGA and also the information gathered will be of great benefit for optimization of the relevant industrial processes.

II. STUDY AREA

Isoko is a region of delta state in southern Nigeria and is inhabited by an ethnic group of same name, the Isoko people. The people of this region are predominately farmer. The region is divided into two Local Government Area Isoko North (headquarters Ozoro) with communities like Ellu, Aradhe, Ovrodhe etc and Isoko South (Headquarters Oleh) with communities like Olomoro Okpe Oleh e,t.c. the region has two distinct seasons. The dry season lasts from about November to April and is significantly marked by the cool harmattan dusty haze from the North-east winds. The rainy season May to October with a brief dry spell (Wikipedia 2018).

SAMPLES COLLECTION

Four samples of palm oil were collected from different palm oil processing mills at Ellu, Aradhe, Okpe, Olomoro, Ovrode all in Isoko North and Isoko South LGA of Delta state, Nigeria. The samples were collected in glass bottles that were properly cleaned. The palm oil was then stored in black polythene bag to prevent exposure to light and transferred to the laboratory for analysis.

PHYSICO-CHEMICAL ANALYSIS OF PALM OIL.

The physico-chemical analysis which includes Ester value, moisture content, Acid value and free fatty acid content, specific gravity, density, saponification value and refractive index determination were carried out using different method of analysis.

DETERMINATION OF ESTER VALUE

Ester value was obtained according to Akinola *et al.* (2010) by finding the difference between the saponification values and acid value.

DETERMINATION OF MOISTURE CONTENT

According to Enyoh et. al. (2017), the aluminium dishes were washed thoroughly and dried in the oven, then cooled in the desicator before they were weighed. 2-5 g of the sample was put in the dish and the weight of the dish with the sample was taken every 30 minutes (Amaobi et al, 2017). Thereafter, it was dried in the oven at 70-80 °C for 2 hours and at 100-135 °C for the next 4 hours and then cooled in the desicator, after which the dry weight of sample plus dish was taken.

DETERMINATION OF REFRACTIVE INDEX

According to the method reported by Onwuka (2005), the Abbes' refractometer was reset with a light compensator (water at 20 °C), then the oil sample was smear on the lower prism of the instrument and closed. A light was passed by means of the angled mirror (the reflected light appears in form of a dark background). After which, the telescope tubes were moved using the fine adjustment until the black shadow appeared central in the cross wire indicator and then the refractive index was read.

DETERMINATION OF SPECIFIC GRAVITY/ DENSITY

The analysis was carried out according to the method reported by Morris (1999).

65ml pycometer bottle was washed thoroughly with detergent, water and petroleum ether, then dried and weighed. The bottle was then filled with water and weighed before it was dried again. After the drying process, the bottle was filled with the oil sample and then weighed.

DETERMINATION OF SAPONIFICATION VALUE

Two grams of oil was weighed accurately and put into a conical flask containing 25 ml of 0.5 M alcoholic KOH. Reflux condenser was fitted to the flask containing the ionic solution and heated in a water bath for an hour swirling the flask frequently. Excess KOH was titrated hot with 0.5M HCl using 1ml of phenolphthalein (1%) solution. The procedure was repeated for the blank.

DETERMINATION OF ACID VALUE AND FREE FATTY ACID CONTENT

The method reported by Akinola et al. (2010) and Enyoh et. al., (2017) was used. The acid value is the number of milligrams of the potassium hydroxide necessary to neutralize the free aid in one gram sample. 10 ml of diethyl ether and 10 ml of n -propanol were mixed and 1ml of Phenolphthalein solution (1%) was added. 2 g of oil was dissolved in the Solvent and titrated with aqueous 0.1 M KOH, shaking constantly until a Pink colour which persists for 15sec. was obtained. The amount of KOH used was recorded. The procedure was repeated for the blank.

QUALITY CONTROL

All laboratory and non-laboratory instrument and chemicals used in this work were in good working condition, of analytical grade and were used according to manufacturer's guidelines. Glass wares and plastic bottles were soaked separately in 15% HCl for 72 hours, washed and rinsed with deionized water and dried.

III. RESULT

Sources of oil sample	Relative Density Value (g)	Perioxide Value (Meq/kg	FFA (%)	pH value	Moisture content	Ester value	Saponification
ELLU	0.8748	18.9068	15.60%	5.30	0.30±0.01	172.86±1.49	202.73±0.09
ARADHE	0.9290	18.8700	15.80%	4.98	0.33±0.11	171.74±2.67	192.49±1.49
OKPE	0.9098	18.8714	16.90%	5.02	0.86±0.94	169.63±0.49	194.60±0.49
OLOMORO	0.9350	18.9481	16.40%	4.00	0.26±0.06	160.86±6.35	198.45±0.00
OVRODE	0.9447	18.8124	16.28%	4.55	0.43±056	168.77±5.35	197.67±40

Table 1

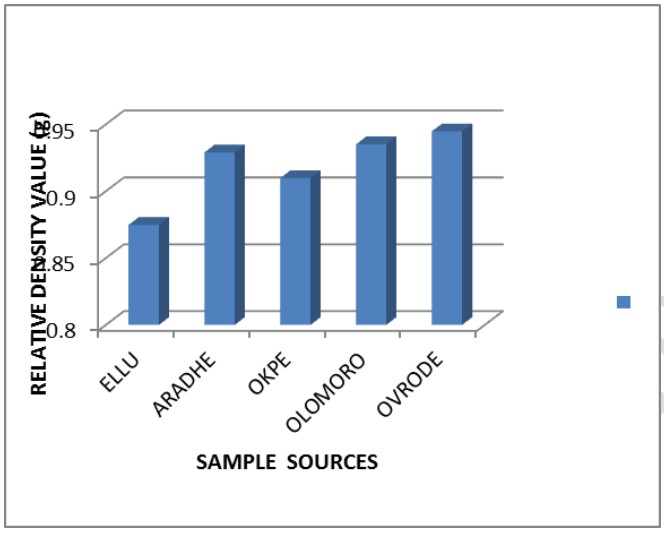

Figure 1: Relative Density of Sample source

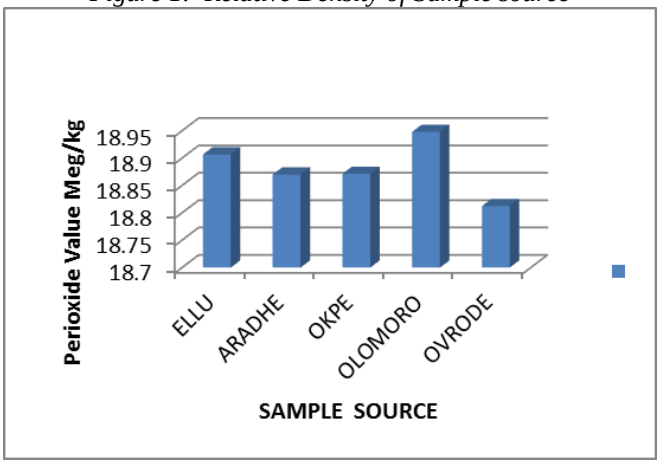

Figure 2: Peroxide value of Sample source

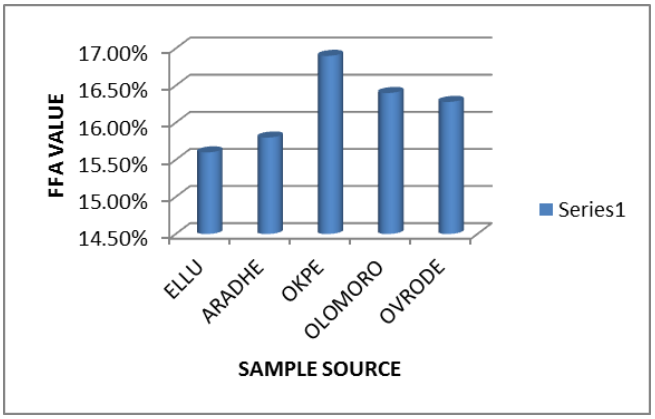

Figure 3: FFA value of Sample source

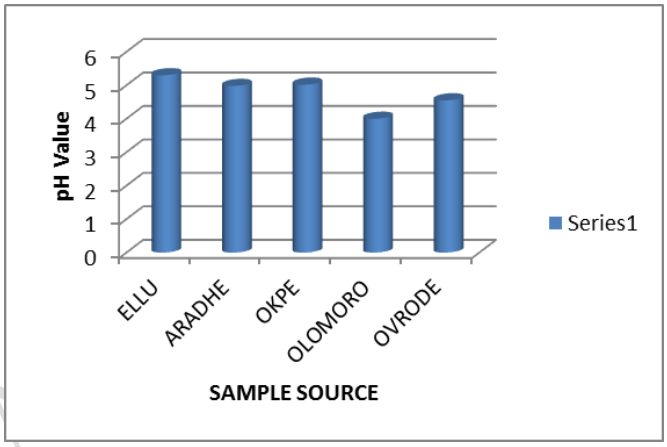

Figure 4: pH value of Sample source

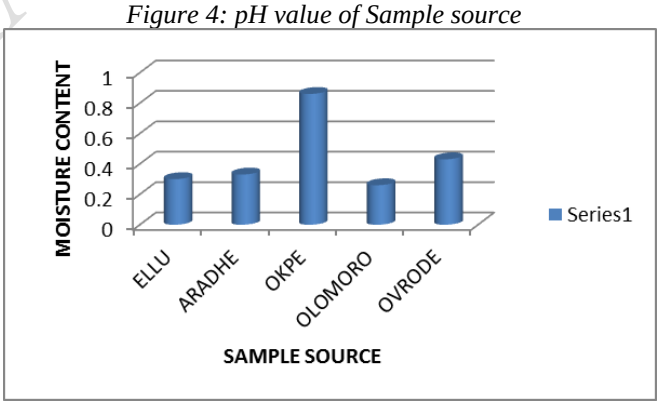

Figure 5: Moisture Content value of Sample source

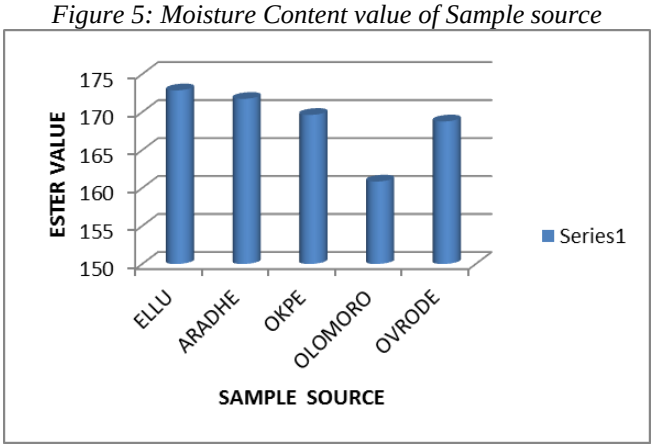

Figure 6: Ester value of Sample source

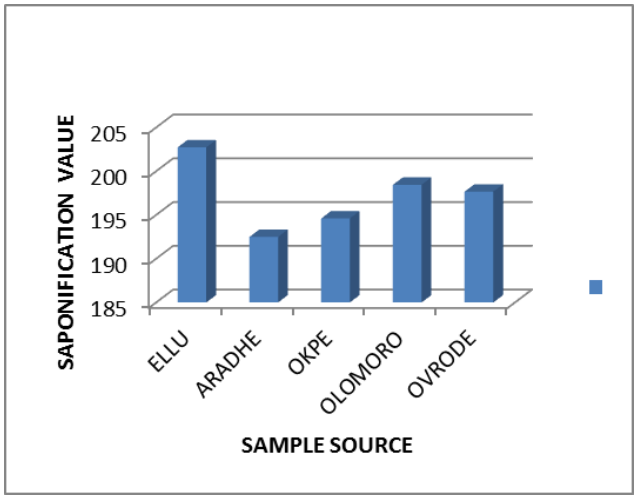

Figure 7: Ester value of Sample source

IV. DISCUSSION

The quality of palm oil depends on its physicochemical state and characteristics and also on its microbiological quality.

FFA VALUE

The maximum acceptable limit for free fatty acid (FFA) is 5% (Ngondo et al.,2011; Ohimain et al., 2012).

Results obtained from the free fatty acid analysis is far above the maximum acceptable limit. The high (FFA) values obtained may be due to the exposure of samples to normal temperature at the mills before processing (Okechalu et al.,2011) or even due to the presence of very high load of both lipid utilizing fungi bacteria, liberating extracellular lipases, which break down ester bonds in lipid molecules to liberate diglycerides, monoglycerides, glycerols and free fatty acids

(Bora and Kalitha., 2007). Egan et al, (1981) stated that glycerides in oil can be decomposed by lipases or other actions and that decomposition can be accelerated by light heat.

PEROXIDE VALUE

The Peroxide value determines the degree of oxidation in oil as well as an indication of level of deterioration of oil and fats (Okechalu 2011) .

The high Peroxide value of the samples indicates an onset of oxidation, which agrees with the reports by Ekpa and Ekpe (1996) who stated that lipid degrading enzymes such as peroxidases and lipooxygenases (Onyeka et al., 2005). Oxidation takes place also, when microorganisms are capable of utilizing fatty acids in the absence of other simple sources of carbon through a catalytic pathway known as ß-oxidation.

pH VALUE

The pH of samples was generally acidic and can be attributed to the presence of high FFA liberated by lipid utilizers.

RELATIVE DENSITY

Relative index of samples was within the acceptable limits by international standards.

ESTER VALUE

The ester value ranged from 160.86 to 172.80 with palm oil from Ovrode having the highest, while palm oil from Olomoro had the lowest ester value. These values obtained are lower than 196.07 reported by Akinola et al. (2010). Ester value is the number of milligrams of potassium hydroxide required to combine with fatty acids present in glyceride form in 1g sample of oil or fat.

MOISTURE CONTENT VALUE

The moisture content of oils is an important parameter in assessing the quality of an oil sample. The moisture content of any food is an index of its water activity (aw) (Fraziar and Westoff, 1978). High moisture content is an indication of ease of spoilage and rancidity as well as short shelf-life. The moisture content of samples ranged from 0.26% to 0.86%, Palm oil from Olomoro had the lowest while palm oil from Okpe had the highest moisture content. Values obtained for palm oil from Ellu, Ovrode, Aradhe and Olomoro were within same range as the 0.29% recommended for fresh oil by SON (2000). The low moisture content obtained will encourage the storage stability of the palm oil samples. It has been stated that the moisture content of palm oil depended directly on the efficiency of the final extraction and clarification processes (Wolves, 1969; Johansson and Pehlergard, 1977; Poku, 2002; Orji, 2006; Mbata and Orji 2008). However, the 0.30% obtained for Ellu was similar to value (0.32 %) obtained by Enyoh et. al., (2017) who reported that the values may be due to the fact that the local producers do not boil the pure oil to reduce the moisture content.

SAPONIFICATION VALUE

Saponification value (SV) is an indication of the molecular weights of triglycerides of oils. High saponification value indicates high proportion of low fatty acids since saponification value is inversely proportional to the average molecular weight or length of The saponification values obtained ranged from 192.49 mg to 202.73mg. Palm oil from Aradhe had the lowest value of saponification while palm oil from Ellu had the highest value. These values are within the recommended range of 195-205 mg KOH/g for palm oil (SON, 2000; NIS, 1992). These values are close to the 222.90 mg KOH/g reported by Akinyeye et al. (2011) but higher than the 140.00 mg KOH/g reported by Birnin-Yauri et al. (2011). These values are indication that the oils are well suited for soap making (Agbaire, 2012).

V. CONCLUSION AND RECOMMENDATION

This research study showed that palm oil produced at different local factories in Isoko Delta state, Nigeria display

varied physical and chemical properties which tend to reflect the stability and quality of the palm oil.

Improvement in the production procedures and processes as well as good seed selection, good handling practices and clean environment can go as far improving the standard of palm oil sold milled in Isoko Delta State.

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