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Analysis on the Physicochemical Properties of Palm Oil Within Isialangwa Local Government Area of Abia State, Nigeria

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Abstract: Physichochemical analysis of palm oil purchased from some markets in Isiala-Ngwa local government area was carried out to determine the level of adulteration and compared with SON standard for palm oil. The results obtained showed that the palm oil samples from Umuihie had the lowest moisture content value of 0.14 %, though none of the sample exceeded the SON standard of 0.29%, the flash point, fire point, smoke point and specific gravity conformed within same standard. The sample from Umuihie had the closest iodine value of 44.60mg/g and 203.50mg/g for saponification value as compared to 45-53mg/g for iodine value and 195-205 mg/g for saponfication value given by SON also the peroxide value and free fatty acid, all conformed with the standard. Though, the level of conformity of Umuihie sample to SON standard was the closest, other samples were still close, hence there is likelihood that most of oil sold in the markets within Isialangwa Local Government Area are not adulterated.

Keywords: Palm Oil, Adulteration, Physicochemical Properties, Analysis

1. Introduction

Palm oil is an edible plant oil derived from the pulp of the fruit of the oil palm *Elaeisguineensis* [1]. it contains a high amount of beta-carotene that is why it is naturally reddish. It is also one of the few highly saturated vegetable fat, palm kernel oil and coconut oil are also included. Semi-solid consistency at tropical room temperature is mainly due to the presence of triacylglycerol of palmitic and oleic acid, though it will more often appear as liquid in warmer countries. Palm oil contains several saturated and unsaturated fats in the forms of glyceryllaurate (0.1% saturated), myristate (0.1% saturated) palmitate (44% saturated), stearate (5% saturated), oleate (39% monosaturated), linoleate (10% polyunsaturated) and linolenate (0.3% polyunsaturated) [2]. Like every vegetable oil, palm oil is designated as cholesterol free [3]. Although saturated fat intake increases both low density and high density lipoprotein cholesterol [4].

In some national economies Palm oil is a catalyst for rural development and potential stability. Many social initiatives use profit from palm oil to finance poverty alleviation strategies. Example includes the direct financing of maghenteh hospital in Makeni, Sierre Leone, through profit made from palm oil grown by small local farmers. Palm oil production is a basic source of income for many of the world's rural poor in South East of Nigeria.

Palm oil plant is the highest oil producing plant [5] with an average 3.5 tons and has an increasing consumer interest in tropical West Africa. It contains approximately 50% saturated fats and 40% unsaturated fat, because of its numerous advantageous properties, such as its high thermal and oxidative stability and its plasticity at room temperature [6]. Palm oil and its products are ideally suited to be used in many food product formulations including margarine soft cheeses, processed cheese, butter, ice cream and milk powder. The use of PO can be maximized by employing modification processes such as fractionation, blending, interesterification and hydrogenation, it can cause substantial and often irreversibly damage to the natural environment. like deforestation and habitat loss of critically

endangered species if the plants are not managed properly [7-8].

Meanwhile, the light yellow to orange-red colour of palm oil is due to the fat soluble carotenoids in terms of retinol which are responsible for the high Vitamin A content [9]. Palm oil is mainly used for edible purposes unlike palm kernel oil which has some other uses in the Oleochemical industry. Infact, culturally it is more valued than other edible oils in Nigeria. Meanwhile, in some tropical countries, it contributes up to 80% of the total edible oil needs.

The importance of quality of palm oil in our diet cannot be overemphasized. It is one of the main vegetable oil, consumed in the world today, accounting for 33% of all oils consumed globally, closely followed by soya oil with 31% [10].

Physicochemical properties of oil are assessed to know the quality, purity and identification. The parameters for determination of properties include iodine value and saponification value, however the peroxide value, free fatty acid value and density varies with the location of the plant. [11], hence these properties as stated above are used to characterise oil.

Recently, there has been wide spread speculations that palm oil is adulterated in order to increase profit margin. With the sudden rise in cases of cancer, organ damages and heart diseases, it has become imperative for Nigerians to pay attention on the quality of palm oil to be used in their diets considering the current trend, producers and marketers add inedible substances or chemicals that could make palm oil appear like the unadulterated one [12].

Sometimes it has been observed that edible palm oil fall short of the recommended quality standards that is considered safe for consumption. The low quality could be as a result of the presence of some inclusion which have been added intentionally by the producers or marketers to enhance quantity, appearance, viscosity and etc. this is adulteration and it is a dangerous practice. The expertise put to use in this process has made it practically impossible to physically differentiate between a good palm oil and the adulterated one, hence consumers look for redness before buying their palm oil. Of course, that is one major attribute of the oil, this situation arose because local production can no longer satisfy demand, hence it is very necessary to examine the quality of the palm oil that is consumed by the local communities or town. This paper presents a study carried out on palm oil samples from some locations in Isialangwa Local Government Area.

2. Materials and Methods

2.1. Materials

Four samples of palm oil were purchased from four different markets in Isiala-Ngwa Local Government Area namely: Umuoloke, Umuihie, Umueze and Amaogwugwu market. The samples were collected in a polyvinylchloride screw capped container filled to the brim and firmly locked. The samples were kept taken to the laboratory for immediate analysis. All the reagents used were of analytical grade made by British Drug House (BDH) Poole England. They were obtained from the department of Chemical Engineering Department, Michael Okpara University of Agriculture, Umudike. Equipment and analytical instruments used were also obtained from the same place.

2.2. Methods

Moisture content was determined using the gravimetric method of air- oven drying to constant weight at 105^{o}C. The specific gravity was determined using a pycrometer gravimetric method as described by [14]. The smoke, fire and flash points were determined according to the method of [13]. The free fatty acid (FFA) content was determined by titrating the alcoholic solution of the oil with a 0.1M NaOH using phenolphthalein as an indicator and then expressed as a percentage of palmitic acid being the major fatty acid in palm oil. Peroxide value, Iodine value and saponification value were determined according to the methods of [15].

3. Results and Discussions

3.1. Results

Table 1. *Physicochemical properties of palm oil from four markets in Isialangwa L. G. A.*

Physicochemical properties	Umueze	Umuoloke	Umuihie	Amaogugwu	SON standard
Smoke point (°C)	121	117	129	124	-
Flash point (°C)	182	175	184	188	-
Fire point (°C)	196	201	220	222	-
Moisture (%)	0.24	0.18	0.14	0.22	0.29
Specific Gravity	0.824	0.898	0.903	0.768	0.897-0.907
Free fatty acid	3.10	2.73	2.82	3.26	3.5
Iodine value	29.56	42.00	44.60	39.92	45-53
Peroxide value	7.90	8.80	6.89	7.40	10
Saponification value	195.20	189.90	203.50	179.80	195-205

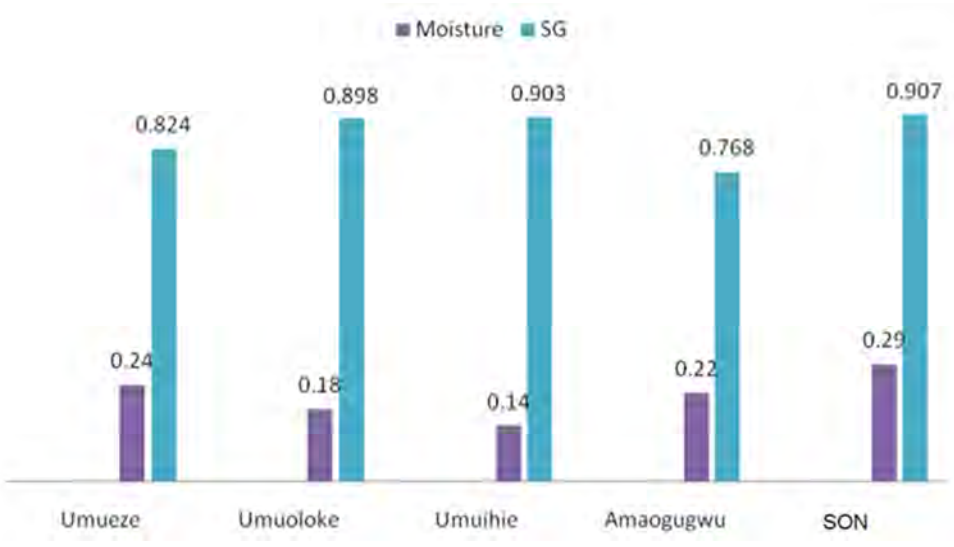

Figure 1. *Bar chart representing the moisture and the specific gravity of palm oil from four markets in Isiala-Ngwa L. G. A.*

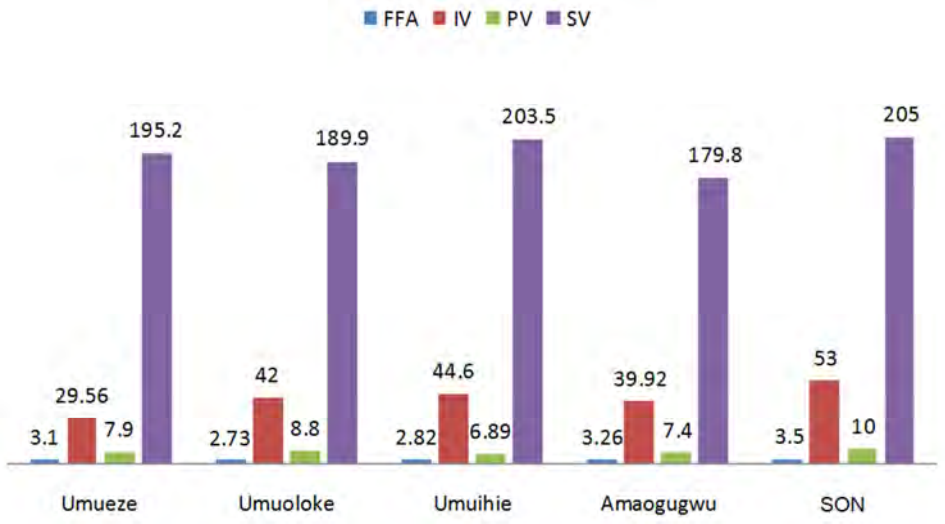

Figure 2. *Bar chart representing the chemical properties of palm oil from four markets in Isiala-Ngwa L. G. A.*

3.2. Discussion

From the result shown in Table 1, the smoke point, flash point and fire point ranged between 121- 222°C, this high value is an indication of suitability of this palm oil for frying purposes.

The low moisture content of the palm oil from Umuihie indicates that its storage stability is better than the other samples, although they all fell within the recommended value 0.29 [16]. For specific gravity, all the samples were within the recommended range except the sample from Amaogwugwu that was below the standard, this indicates that the sample from Amaogwugwu is susceptible to spoilage. Umuhie has the lowest free fatty acid value which indicates that it is very good for human consumption and they are not prepared from rotten palm fruits, also only the sample from Umuihie came closest with an iodine value of 44.60 compared to the value of 45-53 as recommended by [16], this indicates that the oil from Umuihie is highly unsaturated and therefore susceptible to oxidation. The peroxide value determines the extent to which the oil has undergone rancidity, hence all the sample were within recommended value of 10, Samples from Umueze and Umuihie fell within the recommended value of 195-205 for saponification indicating its suitability for soap making. An elaborate view of the variation in the physical and chemical properties of the palm oils in comparison with SON standard is shown in figure 1 and 2.

4. Conclusion

From the analysis carried out, it could be deduced that the palm oil sample from Umuihie had the best physicochemical property that fell within SON standard, although other samples still had properties within the standard. Therefore, it is pertinent to conclude that the palm oil samples studied were not adulterated and that the processing and storage methods employed were adequate, hence its suitability for both domestic and industrial purposes.

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