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PHYSICOCHEMICAL AND ANTIOXIDANT PROPERTIES OF PALM OIL SAMPLES OBTAINED FROM KWALI AREA COUNCIL, ABUJA, NIGERIA.

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Abstract

Four palm oil labeled as (K1, K2, K3 and K4) were collected randomly from a local market in Kwali area council, Abuja. Physicochemical analysis was carried out on the oils to ascertain the qualities of the oil samples. The antioxidant properties were measured in terms of radical scavenging ability using the stable radical 1,1-diphenyl-2-picrylhydrazyl (DPPH) with a concentration of 2.0, 1.5, 1.0, 0.5 and 0.25 mg/ml. The physicochemical analysis results showed that acid value ranged between 20.58-29.87 mgKOH/g; saponification values between (189-210) mgKOH/g; iodine values between (35.35-48.14) wijs; peroxide values between(4.80-32.11) meq/Kg and moisture content between(0.34-1.29)% for the oils. The antioxidant measurement showed K1, K3 and K4 having their highest activities at the concentration of 1.5 mg/ml, while K2 has high activity at 2.0 mg/ml. The high acid values of the four oil samples is an indication that the oil has been subjected to series of oxidation. The high peroxide value of K1 (32.11) meq/Kg is an indication that the oil has become rancid and not safe for consumption.

Keywords; Palm oil, quality assessment, antioxidants, physicochemical properties, adulteration

Introduction

Palm oil is extracted from mesocarp of the fruit of oil palm (*Elaeis guineensis*)[1]. Palm oil is reddish-yellow in colour and contains 50% saturated fats and 40% unsaturated fats[2]. Antioxidants can be man-made or natural substances that prevent or delay some types of cell damage. Antioxidants are found in many foods, including fruits and vegetables. They are also available as dietary supplements. Some common antioxidants include beta-carotene, lutein, lycopene, selenium, vitamin A, vitamin C and vitamin E. Palm oil has been documented as a good antioxidants, rich in carotenoids, inhibit the growth of cancer and also generally acceptable by consumers as a healthy vegetable oil[3-4]. Comparing palm oil with other vegetable oils, red palm oil is the most suitable oil in terms of its phytonutrient content[4]. The quality of palm oil is grossly affected bypoor post harvest handling, production and storage[5]. The antioxidant properties of palm oil have been linked to the presence of phenolic compounds in the oil[6].

Palm oil is commercially available but traders adulterate it for the sole aim of maximizing profit and consumers could be at the receiving end leading to lots of health issues. To avoid these problems, proper routine check needs to be carried out on all the palm oil entering the markets. This study assesses the qualities and evaluate the antioxidant properties of some randomly selected palm oil samples from Kwali market in the FCT, Abuja.

Materials and Methods

Collection of samples

The four palm oil samples were randomly collected from a local market in Kwali Area Council of Federal Capital Territory, Abuja. The samples were taken to the lab for the analysis.

Physicochemical Analysis

The saponification value, acid value, iodine value, peroxide value and volatile matter were determined using standard methods described by [7].

Antioxidant Screening

The free scavenging activity was measured in terms of hydrogen donation or radical scavenging ability using the stable radical 1, 1 – Diphenyl – 2 – picrylhydroxyl (DPPH)[6]. In a typical experiment, 0.1 mM of DPPH in ethanol was prepared and 1 ml of the solution was added to 3.0 ml of the oil solution in ethanol at different concentrations of 2.0, 1.5, 1.0, 0.5 and 0.25 mg/ml). Thirty minutes later, the absorbance was measured at 517 nm and percentage inhibition was calculated using the equation below;

$$\% \text{ inhibition} = \frac{[A_b - A_s]}{A_b} \times 100,$$

Where A_b is the absorbance of the blank; A_S is the absorbance of the sample

Results and Discussion

Table 1. Physicochemical properties of palm oil

Samples	Acid value mgKOH/g	Saponification value mgKOH/g	Iodine value (wijjs)	Peroxide value meq/kg	Volatile matter %
K1	20.59 ±0.02	210.55 ±023	48.14 ±1.03	32.11 ±0.94	0.34 ±0.11
K2	29.87 ± 0.10	196.02 ±0.72	35.35 ±0.90	11.13 ±0.81	0.90 ±0.06
K3	28.26 ±0.11	189.96 ±0.21	35.72 ±0.79	4.80 ±0.08	1.01 ±0.10
K4	20.58 ±0.09	200.86 ±1.01	48.14 ±0.55	10.49 ±0.59	1.29 ±0.20
CODEX	8.0	190 – 209	45 – 55	10 – 15 max	0.2

All results are expressed as Mean ±Standard deviation of triplicate analysis

Table 1 showed the physicochemical properties of the palm oil samples. The acid values of all the samples 20.58±0.09 – 29.87±0.10) mgKOH/g was very high when compared to the World Health Organization (FAO/WHO) standard[10]. This is an indication that series of oxidation as well as hydrolysis of triglycerides of the oil has taken place[8]. The acid value is the number of mg potassium hydroxide required to neutralize the free acid in 1g of the sample[7]. The saponification values of K2, K3 and K4 ranged between 189.96 ±0.21 - 210.55 ±023 mgKOH/g These values falls within the values specified by codex standard (190-209) mgKOH/g. The saponification value of an oil/fat is the number of mg potassium hydroxide required to neutralize the fatty acids resulting from the complete hydrolysis of the sample[7].

The saponifacation value of sample K1 was observed to be slightly higher than the standard. This might have been due to the high peroxide value. Generally oils with high saponification values are suitable for soap making[5]. The iodine (IV) is the measure of the level of unsaturation in the oil[7]. The IV obtained were between 35.35±0.79 – 48.14 ±1.03wijs. IV of sample K2 and K3 were above the the codex standard while that of K1 and K4 were within the codex standard. This shows that the K2 and K3 are more saturated than the K1and K4[7]. The peroxide value is the measure of the level of rancidity that has taken place in the oil[7]. The peroxide value for K1(32.11±0.94) meq/kg was above the maximum range specified by FAO/WHO[10]. The peroxide value is the measure of the extent to which an oil/fat has gone rancid[7]. The high peroxide value makes the oil unsafe for consumption[7]. The volatile matter content of the oils obtained (0.34±0.11 – 1.29±0.20) are higher than the maximum value (0.20)% specified by FAO/WHO [10]. Oil with high moisture content have been found to be susceptible to oxidation and to also boost microbial growth[8].

Table 2. Antioxidant properties of the oils

Samples	**Concentration mg/ml**				
	0.25	**0.5**	**1.0**	**1.5**	**2.0**
	% Inhibition				
K_1	29.01±0.5	23.98±0.92	27.08±1.11	28.24±1.26	29.40±0.97
K_2	11.17±0.18	-	20.02±1.22	20.12±0.83	30.95±0.29
K_3	14.51±0.09	20.61±0.85	16.44±0.63	28.82±0.85	13.93±1.06
K_4	16.63±1.01	26.11±0.26	22.44±2.01	26.31±0.99	23.98±1.22
VIT. C	96.55±0.09	92.98±0.04	97.97±1.09	96.81±0.03	95.07±0.49

All results are expressed in Mean ± Standard deviation of duplicate analysis

Table 2 presents the antioxidant properties of the oil. The antioxidant properties was measured at different concentrations of (0.25, 0.5, 1.0, 1.5 and 2.0) mg/ml. The highest zone of inhibition for K1 and K2 was recorded at 2 mg/ml, while that of K3 and K4 were recorded at 1.5 mg/ml. The % inhibition of K1 increases initially at 0.25 mg/ml and then decreases at 0.5 mg/ml and thereafter increases steadily to 2.0 mg/ml. The K2 has no activity at 0.5 mg/ml and increases steadily to 2.0 mg/ml. For the K3, the % inhibition at 1.5 mg/ml is the highest compared to the other samples. K3 has the highest % inhibition at 2.0 mg/ml while K1 has the highest %inhibition at 0.25 mg/ml. Vitamic C was taken as standard. It has very high % inhibition ranging between 92±0.04 – 97±1.09%. The % inhibition of all the oil samples were being compared to that of vitamin C being the widely used antioxidant.

Conclusion

This study had characterized the qualities of the palm oil samples via physicochemical analysis and the antioxidant activity was also evaluated. The high acid values seen in all the oil samples is an indication that we should consume the oil with caution. Sample K1 has gone rancid and therefore should not be consumed due to the high peroxide value. It is recommended that palm oil products entering the market should be properly checked and certified to ensure that it is safe for consumption.

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