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THE EFFECTS OF DRYING TEMPERATURES ON SOME PHYSICOCHEMICAL PROPERTIES OF EXTRACTED TIGER NUT (*CYPERUS ESCULENTUS*) OIL

Oyedele O. A.*, and Ogunnaike A. F.

Department of Agricultural and Bio-Environmental Engineering, The Federal Polytechnic, Ado-Ekiti, Ekiti State, Nigeria.

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***Corresponding Author**
Oyedele O. A.
Department of Agricultural and Bio-Environmental Engineering, The Federal Polytechnic, Ado-Ekiti, Ekiti State, Nigeria.

ABSTRACT

Oil extractions from agricultural grains or nuts are usually preceded with roasting or drying. The temperature of drying/roasting needs to be monitored in order to obtain quality oil. This study was carried out to examine the effect of different drying temperature on some physicochemical properties of oil from Tiger nut (*Cyperus esculentus*). Fresh Tiger nuts were obtained from Oja-Oba market at Ado-Ekiti. The nuts were weighed and sorted out to obtained good and matured samples. The samples were dried at different drying temperature of 50, 55, 60, 65 and 70^{0}C, after which they were milled and oil was extracted using solvent method. Some physicochemical analysis carried out on the oil obtained from the samples. The data were presented on scattered line graph using excel package. The result indicated that most moisture content, saponification value, acid value, free fatty acid (FFA) and preoxide decreases as the temperature increases. The pH and the refractive index were not affected with temperature variation.

KEYWORDS: Oil, extraction, nut, drying, tiger nut.

INTRODUCTION

Vegetable oil contributes important role to the diet in many countries. Vegetable oils are widely consumed domestically in Nigeria. It is used primarily as a cooking and salad oil. Nuts are a good source of oil containing higher unsaturated fatty acids to saturated fatty acids ratio (Sabate, 2003). Willett (1998) reported that higher body weight is associated with higher percentage of fat in the diet. Oil constitute one of the essential components of balanced diet as good source of energy.

The largest sources of vegetable oil are annual plants, which include soybean, corn, cottonseed, groundnut, sunflower, rapeseed, melon and sesame seed (O'Brein, 2008). The rate of vegetable oil consumption is increasing compared with animal fat due to its low sterol (Akinoso *et al*., 2006).

According to Mandlo *et.al* (2014), the chemical properties of oils are amongst the most important properties that determine the quality and help to describe the present condition of oils. Edible oils from plant sources are of interest in various food and oil application industries. They provide characteristics flavours and textures to food as integral diet components (Odoemelam, 2005) and can also serve as a source of oleo chemicals (Morrison *et al*., 1995).

Oil is obtained from oilseed by either solvent extraction or mechanical expression or the combination of the two processes. For mechanical expression, hydraulic or screw press is employed. The oil is used locally for cooking, lighting and as body cream. It is also used for production of soap, cosmetic and margarine. Further processing improves the quality of the oil (Kheiri, 1985). Good quality edible oil is fresh, pure, free from odours, and any sign of rancidity.

The acceptability of the products at world edible oil market depends on its ability to satisfy basic standard tests for fats and oil (Takakura, 2002).

In Nigeria, tiger nut is available in fresh, semi-dried and dried form in the markets where it is sold locally and consumed even uncooked. Tiger nuts are under-utilized due to lack of information on their nutritional potential (Rita, 2009). Tiger nut has been reported to be eaten raw, fermented and processed as beverages. It has the medicinal quality of preventing colon cancer, heart attack and diabetis (Belewu and Belewu, 2007).

There are numbers of factors that affect the oil quality. Weiss (2000) state that applied pressure, heating temperature, heating duration, moisture content, particle size, handling and storage are factors influencing yield and quality of vegetable oil expression. The degree of influence varies with kind of oilseeds and method of oil expression (Akinoso, 2006).

Traditionally, seeds and nuts are roasted or dried prior to oil extraction. This is usually done to obtain high yield and good quality oil. This study is therefore aimed at investigating the effects on roasting temperature on some parameter of oil potential of chest and tiger nuts.

MATERIALS AND METHODS

Fresh tiger nuts were purchased from Oja Oba market, (a local market) in Ado-Ekiti, Ekiti State, Nigeria. The tiger nuts were sorted out by removing decayed, unmatured and unwanted material so as to ensure good quality oil. A total of 3 kg of sorted tiger nut was used for the experiment. 600 g of the sorted tiger nut was then weighed and divided into three equal parts of 200 g as replicates. The three samples were oven dried at 50^0C for 24 hours. It was then kept in the desiccators for natural cooling and then re-weighed and recorded. Also the same procedures were then repeated for four other temperatures of 55, 60, 65, and 70^0C respectively. The samples were then milled using electric blender to powder form for easy oil extraction (Adebayo *et al.*, 2012) and then stored in an airtight container to prevent moisture absorption.

Oil Extraction

Solvent extraction method was used to extract oil from milled Tiger nuts using soxhlet extractor (Avalier model). 100 g of the milled sample was wrapped with filter paper and masking tape. This was inserted into the condenser of the extractor. The round bottom flask was filled with the solvent (n-hexane) up to two-third capacity of the flask. The reflux condenser was filled to the top of the extractor and water flow was turned on.

The round bottom flask was placed in the heating mantle and temperature of the mantle adjusted to 150^0C so that the solvent is brought to the evaporation point. Each extraction occurred over a period of 8 hours. When the solvent has just siphoned over the barrel, the condenser was detached and the thimble removed. The filtrate was kept in desiccators and allowed to cool at room temperature and the extracted oil was re-heated to remove the n-hexane from the oil through evaporation. These procedures were repeated for each of the five samples dried at 50, 55, 60, 65 and 70^0C.

Physicochemical Properties Determination

Proximate analysis was carried out on each of the sample of oil extracted at different temperatures to determine their physicochemical properties. The physicochemical properties were analyzed using standard methods by AOAC (1998). The properties determined are Oil

Yield, Acid value, Free Fatty Acid, Saponification Value, Peroxide, refractive index, pH value and moisture content.

RESULTS AND DISCUSSION

The results obtained from the study are presented in Table 1. It shows the values of the oil properties observed from the extracted oil from tiger nut at different levels of drying temperature.

Table 1: The Physicochemical properties of Extracted Tiger nut oil.

Oil parameters	Drying temperature (^{0}C)				
	50^{0}C	55^{0}C	60^{0}C	65^{0}C	70^{0}C
Oil yield (%)	18.70	18.80	22.10	23.60	23.70
Acid Value (mg/KOH/g)	1.66	1.40	1.31	1.21	1.01
Free fatty acid (%)	0.84	0.70	0.65	0.56	0.51
Saponification Value (mg/KOH/g)	68.83	68.00	56.10	48.62	46.26
Peroxide value	6.15	4.16	6.27	6.40	6.42
Refractive value	1.46	1.45	1.46	1.45	1.46
pH level	6.10	6.13	6.06	6.10	6.10
Moisture content	27.36	25.95	25.57	17.38	17.08

Data Analysis

The averages of data collected were obtained (Table 1). These values were then presented on the same axis of scattered graph using Excel Spread Sheet (Fig. 1), to determine the trend of the properties against the drying temperatures. The values of R-Square were obtained for each of the properties.

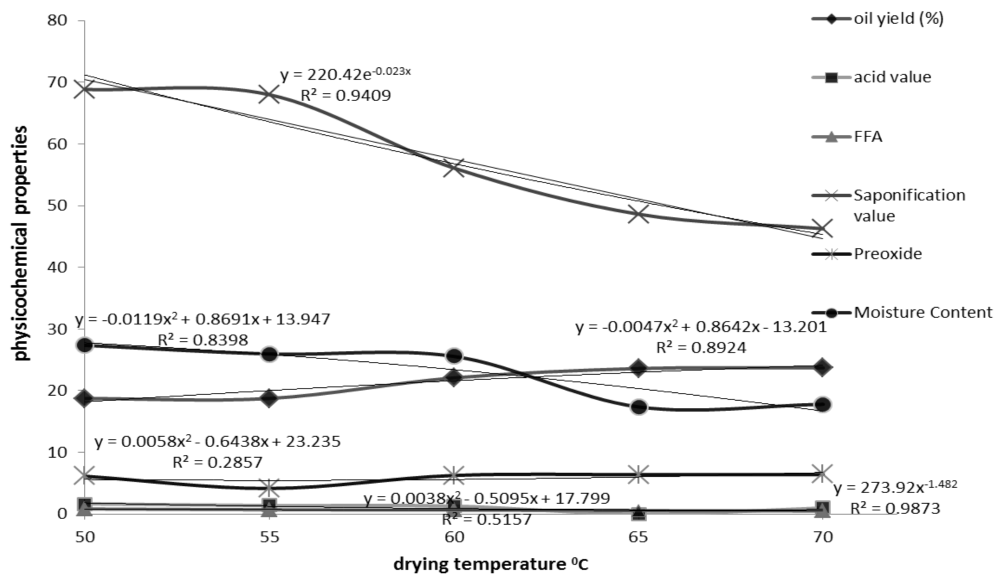

Fig. 1: Relationship of some phsico-chemical properties with drying temperature

DISCUSSION

Oil yield: The result obtained (Table 1) shows that the oil yield increases from 18.7% to 23.7% ^{0}C at drying temperatures of 50^{0}C and 70^{0}C respectively. It shows that as the drying temperature increases more oil is produce. The result presented on graph (Fig.1) reveals the value of R- Square as 0.8923 and form polynomial curve. Similar trend was reported by Makeri et al (2011) for locally-processed oil from two Nigerian peanut (*Arachis hypogea* L.) cultivars and Akinoso et al (2011) for Optimization of roasting temperature and time during oil extraction from orange (Citrus sinensis) seeds. This suggests that heat treatment of the tiger nut at lower temperatures did not ease the removal of the oil much, but this became progressively easier as the temperature is increased. Also this indicates variation of drying temperature affects oil yield.

Acid Value: From Table 1, the result shows that acid value of nut decreases from 1.61 to 1.01. This shows that as the temperature increases there is decrease in the acidic value of the nut. The result presented on graph (Fig.1) reveals the value of R- Square as 0.515 and form polynomial curve. The lower acidity value indicates the extent of the edibility of the oil (Adejuyitan, 2011).

Free Fatty Acid: From Table 1, it can be see that the free fatty acid decreases with increase in heat temperature. The result also shows that the value of R – Square is 0.987 from the graph (Fig. 1). The free fatty acid measures the extent to which the glycerides in the oil had been decomposed by lipase action, which is accelerated by light and heat and as a result a treated tiger nut as a shelf longer life because of the rancidity which usually follows fatty acid formation (Adejumo, 2015).

Saponification: The saponification values gives information concerning the character of the fatty acid present in the oil and the stability of the soap derived from it in water, high saponification value contains low portion of fatty acids (Muhammad, et. al., 2011, Adejuyitan, 2011). From Table 1, the lowest saponification value was observed at the highest temperature (70^{o}C) while the highest at lowest temperature (50^{o}C). This shows that saponification decreases as the temperature increases. This follows similar trend reported by Adejumo, et al. (2015), for quality of tiger nut oil as influenced by heating temperature. The result presented on graph (Fig.1) reveals the value of R- Square as 0.940.

Preoxide: Peroxide value is used to monitor the development of rancidity through the evaluation of the quantity of peroxide generated in the product (initiation product of oxidation) (Adejumo et al., 2015). From the result obtained (Table 1) it was observed that the lowest peroxide value occur sat 55^{o}c and the highest at 70^{o}C and the report presented on graph (Fig.1) shows that the value of R – Square as 0.285.

Refractive Index and pH Values: From Table 1, the result indicates that the refractive index and pH values are not affected by drying temperature as their values of 1.5 and 6.0 respectively remain constant for all the drying temperatures.

CONCLUSION

The effects of drying temperatures on some physicochemical properties of extracted tiger nut (*cyperus esculentus*) oil was carried out. The physicochemical properties tested for were oil yield, acid value free fatty acid saponification, peroxide, refractive index and pH values. The results obtained showed that oil yield increases with drying temperatures. Acid value free fatty acid saponification and peroxide decreases with increase in drying temperature while refractive index and pH were not affected by drying temperatures.

RECOMMENDATION

The researchers recommend that the processors need to have close monitoring of drying temperatures when processing tiger nut for oil production. This will help in extracting good quality oil.

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