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REVIEW OF PALM KERNEL OIL PROCESSING AND STORAGE TECHNIQUES IN SOUTH EAST NIGERIA

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ABSTRACT

An assessment of palm kernel processing and storage in South-Eastern Nigeria was carried out by investigative survey approach. The survey basically ascertained the extent of mechanization applicable in the area to enable the palm kernel processors and agricultural policy makers, device the modalities for improving palm kernel processing in the area. According to the results obtained from the study, in Abia state, 85% of the respondents use mechanical method while 15% use manual method in cracking their kernels. In Imo state, 83% of the processors use mechanical method while 17% use manual method. In Enugu and Ebonyi state, 70% and 50% of the processors respectively use mechanical method. It is only in Anambra state that greater number of the processors (50%) use manual method while 45% use mechanical means. It is observable from the results that palm kernel oil extraction has not received much attention in mechanization. The ANOVA of the palm kernel oil extraction technique in South- East Nigeria showed significant difference in both the study area and oil extraction techniques at 5% level of probability. Results further revealed that in Abia State, 70% of the processors use complete fractional process in refining the palm kernel oil; 25% and 5% respectively use incomplete fractional process and zero refining process. In Anambra, 60% of the processors use complete fractional process and 40% use incomplete fractional process. Zero refining method is not applicable in Anambra State. In Enugu State, 53% use complete fractional process while 25% and 22% respectively use zero refining and incomplete fractional process in refining the palm kernel oil. Imo State, mostly use complete fractional process (85%) in refining palm kernel oil. About 10% use zero refining method while 5% of the processors use incomplete fractional process. Plastic containers and metal drums are dominantly used in most areas in south-east Nigeria for the storage of palm kernel oil.

Keywords: palm kernel, oil, processing, storage, technique, South-East Nigeria.

INTRODUCTION

Palm kernel oil is an edible plant oil derived from the kernel of the palm fruit (*Ekweis guineensis*) (Hartley, 1997). Palm kernel oil which is semi-solid in non-temperature, is more saturated than palm oil and comparable to coconut oil. It is very stable at high cooking temperatures thereby being the best for commercial cooking. It can be stored longer than any other vegetable oil. It is high in lauric acid (Poku, 2002). Palm kernel oil does not contain cholesterol or trans fatty acids. Resembling coconut oil, palm kernel oil is packed with lauric fatty acids ($C_{12}H_{24}O_2$) and therefore suitable for the manufacture of soaps, washing powders and other personal care products. Lauric acid helps in quick lathering. A good soap must contain 15% laurate for good lathering while soap made for sea water usage virtually must be based at 100% laurate (Bachmann, 2005).

The palm kernel oil is highly different from palm oil. The two oil from same fruit are entirely different in fatty acid composition and properties. Palm kernel is an important bio product from oil palm mill/processing. Plant palm kernel constitutes about 45% - 48% by weight of oil in which properties and characteristics are quite different from palm oil rather resembles coconut oil (Gbasonuzo et al. 2012). The major fatty acid (lauric (C_{12}) accounts for about 48% of the fatty acid composition. Other constituents of palm kernel oil includes 16% nuriatic acid (C_{14}) and 15% oleic acid. (C_{18}).

Palm kernel oil is used in manufacturing both edible and non-edible products has a great use both in food industry and non-food industry (Oyinlala et al. 2004). Food usage of palm kernel oil is more saturated and so can be in regenerated to wide range of products for the food industries. It can be used alone or in blend

with other oil for manufacture of cocobutter substances, confectionary fats, biscuit dough's, filling cream, cake icing, and table margarine (Bredeson, 1983). Palm kernel oil is known to confer special attractive physical features and aroma to bakers of bread and other bakery products. It is also used in making chocolate and some other related food products. It is used at home cook industry for cooking different types of food.

Palm kernel oil can be directly combined with petrol diesel or use in making biodiesel for diesel engines. Locally, Africans use the oil to fuel native lamps for lighting in rural communities that are not connected with electricity (Shaver, 2005). It is used in making different non-edible products such as soap/detergent, candle, cosmetics/cream, glue, grease/lubricants for machines, use in product plastics, use in drilling mud for petroleum industry, printing inks, rubbers, pharmaceuticals products e.t.c. (Butcher, 2005)

The process involved in production of palm kernel oil are selection of good palm-kernel-nuts, crushing the nuts with the nut-crusher, heating the seeds with the mechanical seed fryer so as to excite the oil molecules the transferring the heated – crushed nuts to the oil press. The oil pressing machine presses the heated seeds and expels the oil content of the seeds through the oil exit chamber and at same time expels the cake through the cake exit chamber (Oyinlala et al. 2004). The crude oil is collected in drum of high capacity or over head tanks and left to settle. Since the sludge (sediments) or residue is denser than the oil, it settles below the oil. Then the oil can then be collected over the residues and under goes further purification to remove impurities and get brighter colour.

Lack of skilled man power, inadequate provision of machines and poor technology have affected a lot of food and raw material processing in Nigeria; especially in the south-eastern Nigeria. Palm kernel oil is one of the widely used raw materials for a good number of industries in Nigeria. It is widely used in the country and required attention by policy makers in order to enhance, equip and encourage the raw material (palm kernel oil) producers and processors. The main aim of this study is to obtain data on the palm kernel oil extracting techniques and technology involved both in processing and storage which will guide the investors, government policy makers and researchers in devising measures for mechanizing the production and processing in the area.

MATERIALS AND METHOD

Description of the Study Area/Population

The study area comprises of the five eastern states in Nigeria the Abia, Anambra, Ebonyi, Enugu and Imo States. The area involved represents both urban and rural areas. The mostly used palm kernel mills which are located near or in urban area in some states were included. Population of this study comprises only of palm kernel processor both small-medium and giant processors. One hundred (100) processors per state where chosen for this research work. In states where up to 100 is not gotten in urban area, the rural areas close were considered. These mill and processors where chosen randomly.

Questionnaire Administration

Every information concerning palm kernel oil processing, was collected from the palm kernel processors via the use of questionnaire. Prior to the collection of information, some selected processors were gathered through the village heads and cooperative processors. The questionnaire was administered to them. In addition to information obtained from the questionnaires, the researcher visited various palm oil/ kernel oil processing industries in various states for more information about palm kernel oil processing in the study area.

Data Collection and Analysis

Data were collected from the responses of the respondents through the questionnaires, oral interviews with the local processors and personal visits to some local processing units. These data were presented in statistical descriptive tables and percentages; and were analyzed using analysis of variance (ANOVA) in randomized complete block design (RCBD).

RESULTS AND DISCUSSION

The results of this work are presented in tables 1 – 8. Table 1 reveals the palm kernel cracking techniques applicable in south east Nigeria. According to results of this table, most processors use mechanical method to crack their palm kernels. For instance, in Abia state, 85% of the respondents use mechanical method while 15% use manual method in cracking their kernels. In Imo state, 83% of the processors use mechanical method while 17% use manual method. In Enugu and Ebonyi state, 70% and 50% of the processors respectively use mechanical method. It is only in Anambra state that greater number of the processors (50%) use manual method while 45% use mechanical means. The analysis of variance (ANOVA) on palm kernel cracking techniques in south-east Nigeria (Table 2) shows no significant difference in both the study area and in the processing techniques at 5% probability level.

Table 1: Palm Kernel Cracking Technique in South East Nigeria

Study area	No of respondents	Technique	
		Manual method (%)	Mechanical method (%)
Abia	198	15	85
Anambra	196	55	45
Ebonyi	197	50	50
Enugu	200	30	70
Imo	199	17	83

Table 2 ANOVA of Palm Kernel Cracking Technique in South East Nigeria

Sources of variation	Df	SS	MS	F.Cal	F.Tab. 5%
Location	4	21,507.5	5,376.88	0.086^{NS}	6.39
Technique	1	98,015	98,015	1.565^{NS}	7.71
Residual error	4	-250,982.75	-62,645.69		
Total	9	-131,060.25			

NS = Not significant; ** = highly significant

Table 3 shows the palm kernel oil extraction technique in South- East Nigeria. It is observable from the results that palm kernel oil extraction has not received much attention in mechanization. In Abia state, 45% of the respondents said that they use manual method in extracting the kernel oil, 40% use mechanical means (machines), while 10% and 5% respectively use traditional and solvent method in extracting the palm kernel oil. In Anambra state 40% of the processors use traditional method in extracting the kernel oil, 25% use manual and mechanical means respectively in extracting the kernel oil while 10% only use solvent method. In Ebonyi state, 5% of the processors use traditional means, 30% use

machine, 15% use manual method and 5% use solvent method in extracting oil from the palm kernel. Enugu state recorded the highest mechanical method of oil extraction (60%); 20% of processors in E nugu use traditional means while 10% use both manual and solvent method of oil extraction. In Imo state, 45% of the processors use machines while 30%, 15%, and 10% of the processors use manual, traditional and solvent methods respectively in extracting oil from the palm kernel. The ANOVA of the palm kernel oil extraction technique in South- East Nigeria (Table 4) showed significant difference in both the study area and oil extraction techniques at 5% level of probability.

Table 3: Palm Kernel oil extractions technique in South-East Nigeria

Study area	No of respondents	Traditional method (%)	Technique		Solvent (%)
			Manual method (%)	Mechanical method (%)	
Abia	198	10	45	40	15
Anambra	196	40	25	25	10
Ebonyi	197	50	15	30	5
Enugu	200	20	10	60	10
Imo	199	15	30	45	10

Table 4: ANOVA of Palm Kernel oil extraction technique in South-East Nigeria

Sources of variation	D.F	SS	MS	F.Cal	F. Tab 5%
Location	4	-9799	2,449.75	5.146*	3.26
Technique	3	24,873.5	8,291.17	17.417*	3.49
Residual error	12	5,712.5	467.042		
Total	19	20,786.7			

NS = Not significant; ** = highly significant

Table 5 presents the palm kernel oil refining technique in South-East Nigeria. In Abia state, 70% of the processors use complete fractional process in refining the palm kernel oil; 25% and 5% respectively use incomplete fractional process and zero refining process. In Anambra, 60% of the processors use complete fractional process and 40% use incomplete fractional process. Zero refining method is not applicable in Anambra state. In Enugu sate, 53% use complete fractional process while 25% and 22% respectively use zero refining and incomplete fractional process in refining the palm kernel oil. Imo state, mostly use complete fractional process (85%) in refining palm kernel oil. About 10% use zero refining method while 5% of the processors use incomplete fractional process. The statistical analysis (ANOVA) conducted on the palm kernel oil refining techniques in South- East Nigeria (Table 6) showed no significant difference on the study area and highly significant difference on the refining techniques at 5% probability level.

Table 5: Palm Kernel Oil Refining Technique in South-East Nigeria

Study Area	No of respondents	Zero Refining (%)	Fractional Refining Process	
			Complete fractional process (%)	Incomplete fraction process (%)
Abia	198	5	70	25
Anambra	196	-	60	40
Ebonyi	197	30	40	30
Enugu	200	25	53	22
Imo	199	10	85	5

Table 6. ANOVA of Palm Kernel Oil Refining Technique in South-East Nigeria

Sources of variation	D.F	SS	MS	F.Cal	F. Tab 5%
Location	4	3.333333	0.833	0.0007^{NS}	3.84
Technique	2	24,708.4	12,354.2	10.174**	4.46
Residual error	8	9,714.26	1,214.28		
Total	14	34,425.26			

NS = Not significant; ** = highly significant

Table 7 shows the results of packaging/storage techniques adopted by the processors in south-east Nigeria. Plastic container and metal drums are dominantly used in most areas in south-east Nigeria for the storage of palm kernel oil. About 65% of the respondents in Abia state use metal drums to store their palm kernel oil, while 25% of them store in plastic containers, 5% store in glass bottles and local clay pots respectively. In Anambra state, 70%, 25% and 5% of the processors respectively store their palm kernel oil in plastic container, glass bottles and metal drums. They do not use local clay pots in storing palm kernel oil. In Ebonyi state, 35% of the processors use plastic containers, 30% use metal drums while 20% and 15% use local clay pots and glass bottles respectively in storing the palm kernel oil. In Enugu state, 55%, 40% and 5% of the respondents respectively use metal drums, plastic containers and glass bottles in storing the palm kernel oil while local clay pot is not used for storage of oil the area. Finally, 70% of the processors in Imo state use metal drums, 28% use plastic container and 2% use glass bottles. They do not store palm kernel oil in local clay pots. Statistical analysis (ANOVA) on storage techniques of palm kernel oil (Table 8) showed no significant difference in the area and storage techniques applicable in the area at 5% level of probability.

Table 7: Packaging / Storage Technique

Study Area	No of respondents	Local clay pot (%)	Plastic contained (%)	Glass bottles (%)	Metal drums
Abia	198	5	25	5	65
Anambra	196	-	70	25	5
Ebonyi	197	20	35	15	30
Enugu	200	-	40	5	55
Imo	199	-	28	2	70

Table 8. ANOVA of Packaging / Storage Technique

Sources of variation	D.F	SS	MS	F.Cal	F. Tab 5%
Location	4	2.5	0.625	0.0001^{NS}	3.26
Technique	3	24,113	8,037.67	1.723^{NS}	3.49
Residual error	12	55,974.5	4,664.54		
Total	19	80,090			

CONCLUSION

It is observable from the results that palm kernel oil processing has not received much attention in mechanization in South- East Nigeria except in the cracking of the kernels.

Most processors use manual and traditional method in extraction of the oil from the kernels. Complete fractional method is dominantly used in South-East Nigeria in refining the oil after extraction.

Plastic containers and metal drums are dominantly used in south east Nigeria for storage of palm kernel oil.

RECOMMENDATION

Based on the above conclusions the following recommendations can be made about the study:

Government should provide grants, loans and subsides to palm kernel oil processors in the area to enable them cope and probably procure the machines that can be used in processing of palm kernel instead of manual and traditional method.

There should be public enlightenment in form of workshops and seminars through which the palm kernel processors should be educated on the new methods for improving palm kernel processing in the area.

Mechanized method of palm kernel processing at every stage should be introduced to the processors in the area and other areas with similar processing crises to enable them boost up/or improve on their palm kernel processing.

REFERENCES

Gbasouzor AI, Okeke AC, Chima LO. (2012). A Plant Design for Mechanical Extraction of Nmanu Aki (Palm Kernel Oil) Using Complete Pretreatment Process : Proceedings of the World Congress on Engineering and Computer Science 2012 Vol II.WCECS 2012, October 24-26, 2012, San Francisco, USA..

Hartley CWS. (1997). The Oil Palm. New York: John Wiley & Sons, Intermediate Technology Development Group, Principles of Oil Extraction, Technical Briefs, Intermediate Technology Development Group [Online]. http://www.itdg.org/docs/technical_information_service/oil_extraction.pdf

Poku K. (2002). Small Scale Palm Oil Processing in Africa. Rome: Food and Agriculture Organization of the United Nations,

Oyinlala A, Ojo A, Adekoya LO. (2004). Development of a laboratory model screw press for peanut oil expression. Journal of Food Engineering. 64(2): 217-227.

Bachmann J. (2005). Oilseed Processing for Small-Scale Producers. National Sustainable Agriculture Information Service. http://attra.ncat.org/attra-pub/oilseed.html

Bredeson DK. (1983). Mechanical Oil Extraction. Journal of the American Oil Chemists' Society. 60;(2): 211-213.

Butcher D. (2005). Pedal Powered Generator. David Butcher's Personal Page. http://www.los-gatos.ca.us/davidbu/pedgen.html

Shaver M. (2005). Bicycle Powered Generator. Matt Shaver's Home Page. http://users.erols.com/mshaver/bikegen.htm