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Effect of Three Plant Leave Extracts on Yield and Selected Quality Attributes During Traditional Palm Oil Processing In Western Nigeria.

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ABSTRACT

Three different non hazardous plant leaf extracts (*Sida acuta, Ficus benghalensis and Jatropha curcas*) were applied during production of food grade oil from palm fruits using the traditional technique with slight modifications, to obtain food grade cooking oil. The control in this study had no plant extract additives. The effect of plant extract addition on yield and selected quality attributes were evaluated. Oil extraction yields increased by 250%, 167%, 225%, and 120% respectively for *Jatropha curcas*, F*icus benghalensis*, and *Sida acuta* compared to the control. Physico-chemical analysis over a four month storage period showed that the oil extract obtained using Sida acuta and Ficus benghalensis leaves were of better quality compared to the control and Jatropha curcas samples. Overall findings indicate that the use of some plant leaves could contribute to better yield and quality of oils from palm fruits in Nigeria.

Keyword –Plant, leave, extracts, yield, quality, attributes, Palm Oil, Western Nigeria.

Aims Research Journal Reference Format:
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1. INTRODUCTION

Palm is one of the three most important vegetable oils in the world's oil and fats market, following Soya oil and groundnut oil (Hartley, 1988). Oil palm (Elaeis guieneesis) is the most productive oil producing plant in the world with one hectare of oil palm producing between 10 and 35 tones of fresh fruit bunches per year. The oil palm (otherwise known as palm kernel) is a monocotyledonous plant, and within in the species of E. guineensis, different varieties and quality of the extractable oil. The simple classification of the oil palm fruit based on its internal structure, especially the thickness of its shell and fruit form may be described as belonging to the group dura, teneras and pisifera, each having its own peculiar characteristics.

The oil palm is largely cultivated in the equatorial regions of Africa, South East Asia, and America. According to Ataga et al. (1993), extraction of palm oil is production of oil from the mesocarp of the palm fruit, which are of three varieties. Usually, the harvested part is the fruit "fruit bunch" whereby oil is obtained from the fleshly mesocarp. Oil extraction from flesh amounts to as least 45-46% while kernel accounts for at least 40-50%. Oil palm is the only fruit that can be two types of oil extracted from the fruit of the oil palm which are chemically different. Crude palm oil contains fatty acid esters of glycerol commonly referred to as triglycerides and has therefore contributed to the world's need of edible oils and fats. It is composed of approximately 50% saturated fats primarily palmitic acid) and 40%unsaturated fats (principally linolenic and oleic acid, a unique composition when compared to other major fats (Usoro, 1974). The palm fruit is reddish because it contains a high amount of beta carotene. It is used as cooking oil, to make margarine and is a component of many processed foods. A few minutes of boiling destroy carotenoids and the oil becomes colorless.

Palm oil can be extracted using different methods including solvent extraction, mechanical extraction and traditional method. The conventional method is a slow process and usually results in poor quality and low yield. It is estimated that the efficiency of the method is about 40-45%. In spite of this, the method is widely and commonly used. Therefore, there is a need to improve on this method in order to increase efficiency (Hartley, 1988). Studies have shown that when certain leaves are boiled and pounded with palm fruit, could increase oil yield (Igwe and Onyegbado 2007). Consequently the objective of this study was to evaluate the influence of some plant leaves on the yield of oil from palm fruits and to evaluate the physiochemical properties of the oils obtained as an index of quality.

2. MATERIALS AND METHODS

Collection of Sample

The palm kernel fruits used for production of the palm oil were purchased from a local market in Osun State, Nigeria. The leaves Sida acuta, ficus benghalensis (Banyans) and Jatropha curcas (Jatropha) were obtained from Offa, Kwara State, Nigeria.

Stages of oil Extraction from Palm Fruit.

The main stages involved in the extraction of oil from palm fruits are shown in figure 1.

Boiling of Palm Fruits

The traditional technique was adopted with some modifications to extract oil from palm fruit. Fully ripened palm fruits (5kg), with or without added plant leaves (100g each), boiled for two hours to tenderize the mesocarp. The tenderness of the fruits was examined to ascertain their readiness for the next stage of operation. Readiness was confirmed by the ease of removal of the outer layer (mesocarp) of the fruit.

Pounding of the Boiled Fruits

After boiling, the fruits were transferred into a wooden mortar and pounded manually until a mash was obtained. The pounding was carried out until all the endocarp and Mesocarp were completely separated or detached from kernel, the process which took about 45 to 60 min.

Crude Oil Extraction

The mash was separated into the pulp and the kernel. The pulp obtained was mixed with warm water (~ 90^{o}C) and left for 25minutes. Extracted crude oil, floating on the mash, was skimmed off into a container and was thereafter subjected to further boiling for a period of about 1hr.

Boiling of Crude Oil

The crude oils obtained were subjected to further boiling for approximately 1hr. to improve on its level of purity, as the crude oil obtained may still contain some water, 1% (v/v) water in oil helps prolong the storage of the oil. (Poku,1988).

Filtration

The oil was now filtered out by decanting it, after which it was stored at room temperature, inside clean plastic container.

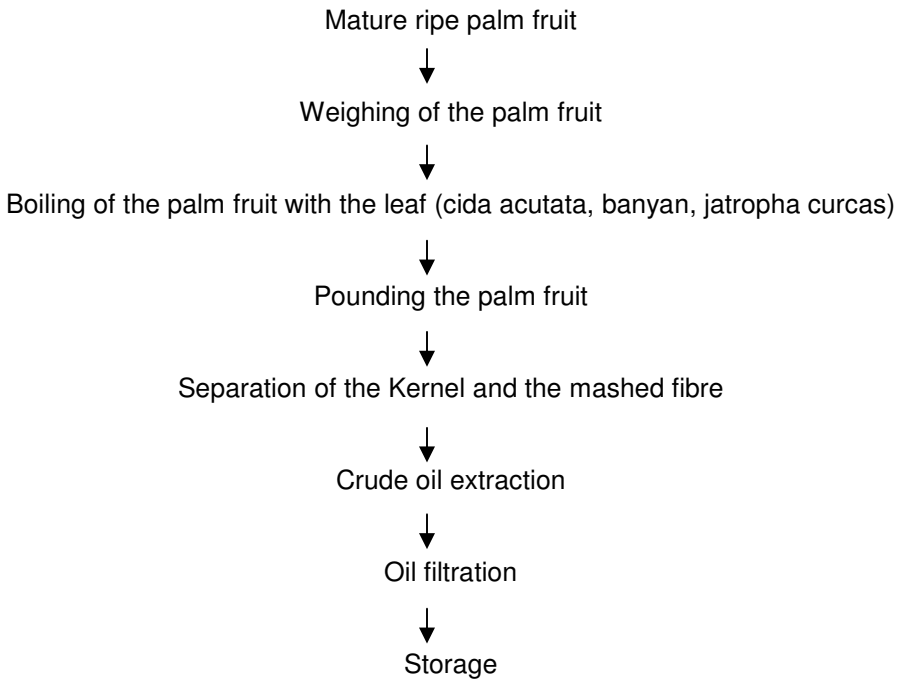

Figure 1: Extraction of oil from palm fruit.

Physiochemical analysis

The physicochemical analyses of the oil samples were determined using the methods of Pearson (1981). The samples were analyzed for moisture, specific gravity, refractive index, saponification value, free fatty acids, peroxide value and melting point temperature.

3. RESULT AND DISCUSSION

Palm oil forms the major consumption of oils in Nigeria and other countries in West Africa. This has been due largely to the cultivation of palm fruits in this region. Traditional techniques are employed in the extraction process of oil from the fruits and modern extraction techniques are rarely used. Losses have been associated with the traditional methods of extraction; hence research efforts aimed at improving efficiency such methods. In this study various leaves were employed during the traditional extraction process.The results of physiochemical analysis of the oil samples extracted using different leaves are represented in Table 1. The moisture content of the oil samples ranged between 0.89% and 1.18%, with the highest and lowest values being recorded for samples C and A respectively. Moisture is usually a critical factor affecting the shelf life of foods, including oils. Generally, very low moisture content has been known to play vital roles in prolonging the shelf life of most food products (Olaoye et al, 2006). It is an important intrinsic factor that has close relation with water activity (a_w). The moisture contents of the oil samples obtained in samples were very low and this could help in enhancing their storage stability. Similar `findings were reported by Mmarurat (2003). Hartley (1988) has published the moisture contents of range of 0.5-1.0% as acceptable levels in most oils to ensure their stability and enhanced shelf life.

It follows that the values obtained for the moisture in oil samples, especially samples A and D, were satisfactory and within acceptable threshold levels, an indication that they would likely keep well,(Hartley 1988). Oil samples did not differ significantly in their moisture, despite the use of different plant leaves during the extraction, despite the use of different plant leaves during extraction.

Hence the plant leaves did not seem to affect the oil quality, in terms of their moisture levels. It should be noted that higher moisture content could promote spoilage in most oils, as oil reversion and rancidity may be promoted (Poku, 1998). The specific gravity of most fats and oils ranges between 0.891 and 0.917. The values obtained in this study as shown in table 1 were noted to compare favorably with that of Morri (1999). The result obtained shows that the oil samples had a high level of purity, as specific gravity is an important parameter used to measure the level of purity and adulteration of oils. This could also have direct influence of the storage potentials of oil, higher specific gravities are usually linked with longer period of storage before spoilage start to set in.

Saponification value of the oil samples obtained for A, B, C and D respectively were 181.13; 179.03; 176.81 and 185.06 respectively. The samples had close similarities with other types of oils including olive oil whose values ranged between 185-196 and grape seed oil, 170 to 179. From the result it could be said that sample A and D may be suitable for use in the food and pharmaceutical industries for the manufacture various items for human consumption. Higher saponification values lead to offensive odours in oils. The melting points of the oil samples were within the range reported by Ihekoronye (1999). This is a god indication that oil samples may therefore be useful in the manufacture of soft and easy digest margarine and other food products. The refractive index of most oils range from 1.4520 – 1.4646 (Morris, 1999). As shown in this study, refractive indices of then palm oil samples compared favorably well with some other oils such as peanut oil (1.4620) and almond oils (1.4646). The refractive index of the oils also indicated that could be free fro impurities or other forms of adulterants.

Free fatty acids (FFA) obtained for oil samples A, B, C and D obtained were 4.30, 3.20, 2.50 and 5.50 respectively. Sample D was observed to compare favorably with other oils such as melon seed oil and olive oil. Sample A, B and C was suitable for direct consumption. Since lipids high in FFA values could cause increase blood cholesterol. Therefore, going by the high content of FFA in sample D, it indicates that it could be better used for some other purpose other than direct consumption.

4. CONCLUSION

In conclusion, it was observed that different plant leaves used in oil extraction processes produced oils of slightly varying qualities. Leaves Sida acuta, ficus benghalensis (Banyans) and Jatropha curcas (Jatropha) resulted in enhanced yield of oils from palm kernel fruits when compared to the control without any leave added. More studies are required on the shelf life of the oils obtained by the use of the plant leaves. In addition more toxicology studies should be performed on the leaves as well as derived oils from the public health standpoint. Further work is needed to focus on the micro biota of the leaves used in this study as stated above as well as the characteristics of oils produced by their use, as this is very important in predicting safety and shelf life of such oils.

Table 1: Physiochemical analysis of the oil samples obtained after treatment with the different leaves.

Quality Parameters	**A**	**B**	**C**	**D**
Moisture Content (%)	0.89	1.05	0.90	1.18
Specific Gravity (%)	0.916	0.917	0.891	0.917
Saponification Value(mg KOH/g)	181.29	179.03	176.81	185.06
Free fatty acid (%)	4.30	3.20	2.50	5.50
Peroxide value (mg /kg)	7.93	0.97	2.82	1.46
Melting point (^{0}C)	80	70	85	74
Refractive index	1.46168	1.46127	1.48528	1.46257

Values are means of three replicates
A, Oil extracted using sida acuta leaves
B, Oil extracted using benghalensis leaves
C, Oil extracted using Jatropha curcas leaves
D, Oil extracted with no addition of leaves (control)

Table 2: Yields of oil based on the different plant leaves

Samples	**QTY of fruit (kg)**	**Qty of leaves (g)**	**Yield of Oil(ML)**	**% Yield**
A	5	100	300	250
B	5	100	270	225
C	5	100	200	167
D	5	100	120	100

Values are means of three replicates
A, Oil extracted using Sida acuta leaves
B, Oil extracted using benghalensis leaves
C, Oil extracted using Jatropha curcas leaves
D, Oil extracted with no addition of leaves (control)

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