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Technical Note

The Quality of Some Locally Processed Nigerian Palm Oils: An Estimation of Some Critical Processing Variables

ABSTRACT

The qualities of palm oils obtained from four different indigenous processing techniques were assessed with respect to the free fatty acid (ffa) content, peroxide value, moisture content and impurity levels. Four oil samples, designated A–D, were analysed, three of which were locally processed using the traditional methods while the fourth was processed mechanically. Although the techniques investigated are prevalent in Oshimill Local Government Area of Bendel State, they are also practised elsewhere in Nigeria.

The mechanically-processed palm oil (sample A) had the lowest ffa content of 4·90% followed by 7·04, 9·98 and 12·24%, respectively, for samples C, D and B. The peroxide values ranged from 2·70 meq kg^{-1} in sample B to 7·40 meq kg^{-1} in sample C. The mechanically extracted oil had the highest residual moisture of 2·96% while sample D had the lowest value of 0·43%. Generally, the impurity levels were highest in the traditionally processed oils. Distinct variabilities were observed with respect to all the parameters estimated, due to differences in the processing methods. Some measures, which include sterilization of fruits soon after harvest and the use of more efficient filtering methods, are suggested to enhance the quality of the traditionally processed oils.

INTRODUCTION

Palm oil, which is an important ingredient in the diets of many Nigerians and other African nationals, is a product extracted from the fleshy mesocarp of

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the oil palm-fruit (*Elaeis guineensis*). Palm fruit processing for oil in Nigeria may be categorized into: (a) the traditional method and (b) the modern method, the bulk of the oil produced being by the former method. In parts of the country where 'banga' soup is popular, it takes less than a day to produce clear oil from the fruits after they have been separated from the bunch either by hand picking, chopping or beating. The fruits are boiled to soften the pulp and then pounded. The oil is squeezed out, sieved and used immediately. For commercial oil production by the traditional method, the mode of fruit separation is the same as that for banga production except that the bunches are left to ferment for some time (as much as 5 days) before processing, usually in pits, pots, drums, and sometimes the fruits are trampled by foot in a canoe before the oil is separated by boiling and skimming.

In the modern method, the bunches are harvested when the fruits are at optimum ripeness and handled with care to avoid bruising. The fruits are thereafter sterilized, threshed and digested. The crude palm oil is extracted hydraulically or by screw press and clarified.

The qualities of palm oil will generally vary according to the processing methods employed (Coursey, 1966; Broadbent & Kuku, 1977). These qualities include free fatty acid (ffa) content, moisture content, peroxide value, iodine value, anisidine value, bleachability, copper and iron content.

The various uses to which these oils are put require them to be of high quality to prevent those factors that cause their deterioration. Moulds are known to cause biochemical deterioration of infected oils, resulting in poor quality of such oils. These changes are usually in the form of increase in free fatty acid, caused by lipolytic moulds, and decrease in bleachability. However, ffa content is the most important criterion for determining the quality of oils meant for export (Kuku & Agboola, 1984), financial penalties being imposed on oils with high ffa.

The present paper provides preliminary data on the relationships between some qualities of locally processed palm oils and the processing methods employed, especially in some selected areas of Oshimili Local Government Area of Bendel State of Nigeria.

MATERIALS AND METHODS

Collection of palm fruits

All the fruits (*Elaeis guineensis*) extracted for oil were harvested from the palm plantation of the Bendel State College of Agriculture, Asaba. The bunches were harvested when fully ripened as judged by the presence of about four to eight loose fruits on the ground around the base of the palm

tree. The fruits were subsequently divided between each of the four processing techniques.

Extraction/processing

Figures 1–4 represent the flow charts for the four prevalent palm oil processing techniques in Oshimili Local Government Area of Bendel State. Where any of the methods entailed dehydration of the crude oils by boiling, the oil was usually boiled until foaming ceased. In the traditional methods, filtration of oils employed the use of special filters fabricated from palm fronds.

The oil samples were stored in tightly covered bottles and labelled A–D, corresponding to each of the flow charts. Sample A was processed

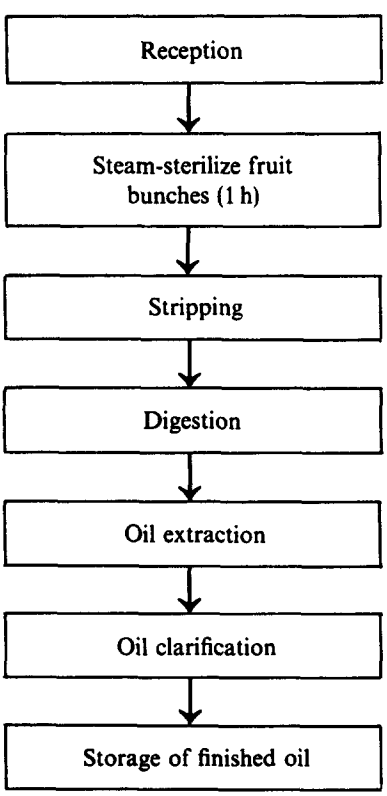

Fig. 1. Flow chart for small scale mechanically processed palm oil (sample A).

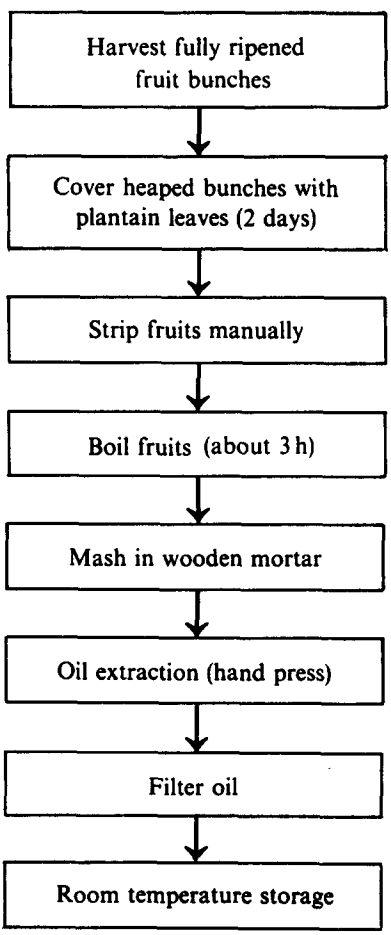

Fig. 2. Flow chart of a traditional process (sample B).

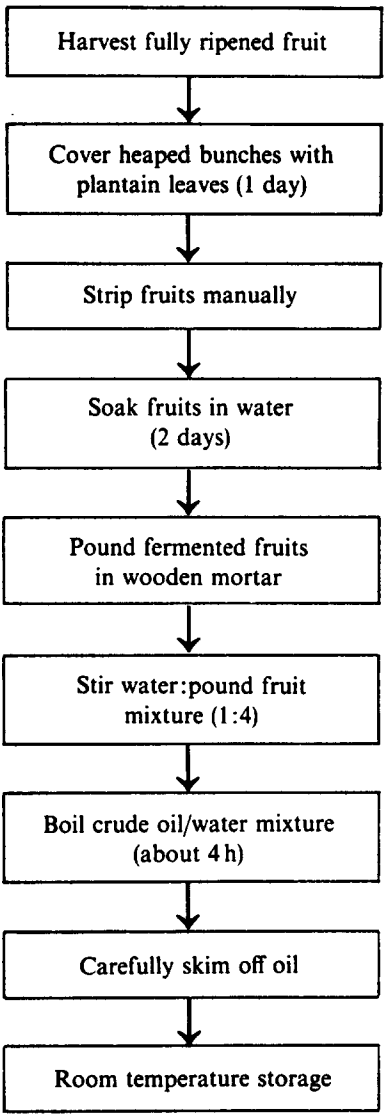

Fig. 3. Flow chart of traditional process (sample C).

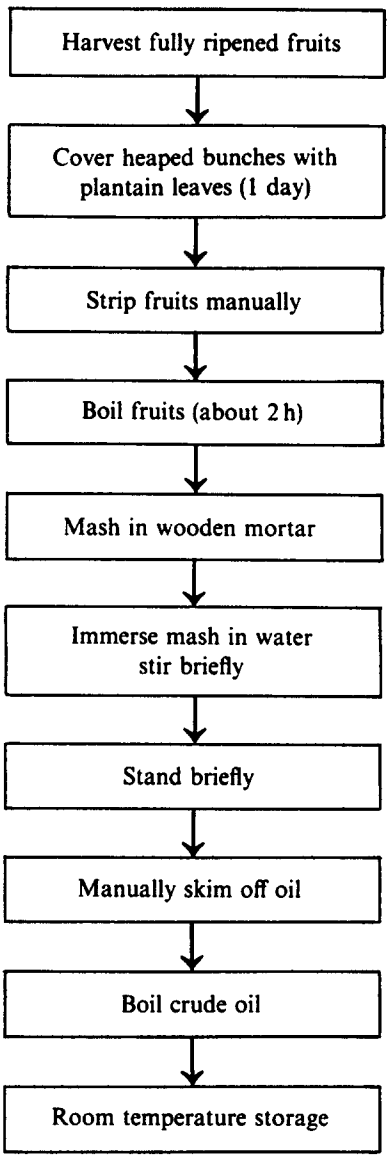

Fig. 4. Flow chart of traditional process (sample D).

mechanically using the College palm oil mill, while samples B, C and D were processed by traditional methods.

Analytical procedures

The free fatty acid (ffa), peroxide value, moisture content and impurity levels in the oils were determined by methods of the Association of Official

Analytical Chemists, AOAC (1975). The ffa contents of the oils were determined by titrating the alcoholic solution of the oils with an aqueous solution of sodium hydroxide using phenolphthalein as indicator. The ffa was then expressed as palmitic acid, the major fatty acid in the oils. The peroxide value was determined by titrating chloroform/glacial acetic acid/KI solution of the oil with an aqueous solution of sodium thiosulphate using starch as indicator. Moisture was determined by the gravimetric method of air-oven drying to constant weight at 105°C. The impurities were obtained after the dissolution of the oil in petroleum ether, followed by filtration and, finally, soxhlet extraction before oven-drying to constant weight. The means and standard deviations were thereafter calculated (Steel & Torrie, 1960).

RESULTS AND DISCUSSION

The influence of the processing technique of palm oil on the ffa content, peroxide value, moisture content and impurity levels is illustrated in Table 1. Sample A, which was mechanically processed, had the lowest ffa content of 4·90%, followed by 7·04, 9·98 and 12·24%, respectively, for samples C, D and B. The peroxide value ranged from 2·70 meq kg^{-1} in sample B to 7·40 meq kg^{-1} in sample C. The mechanically processed oil had the highest residual moisture of 2·96% while sample D had the lowest value of 0·43%. Generally, the impurity levels were highest in the traditionally processed oils. Distinct variabilities were observed with respect to all the parameters estimated due to differences in the processing techniques.

The various uses to which vegetable oils are put are dictated, amongst others, by certain quality characteristics such as ffa, peroxide value, moisture

TABLE 1
Effect of Processing Technique on Some Processing Variables in Palm Oil

Samples	*FFA* (%)	*Peroxide value* (*meq* kg^{-1})	*Moisture* (%)	*Impurities* (%)
A	4·90 ± 0·57	5·60 ± 0·33	2·96 ± 0·29	0·05 ± 0·02
B	12·24 ± 1·36	2·70 ± 0·67	1·07 ± 0·11	0·20 ± 0·11
C	7·04 ± 0·83	7·40 ± 1·22	1·80 ± 0·41	0·64 ± 0·28
D	9·98 ± 1·10	4·40 ± 0·44	0·43 ± 0·17	0·73 ± 0·17

Means are for three determinations.

content and impurity levels. However, ffa content is the most important criterion for determining the quality of oils meant for export, financial penalties being imposed on oils with high ffa (Kuku & Agboola, 1984). For example, in palm oil, the ffa content must not exceed 5% (expressed as palmitic acid); the acceptable level for groundnut oil is 3% (expressed as oleic acid) while palm kernel oil must not contain more than 4·75% (expressed as lauric acid) (Coursey, 1966). Oils with ffa values within these ranges are termed special grade oils while those with higher values are termed technical grade oils. The present study indicates high variations in the ffa content of the palm oil due to the processing techniques. Thus, the traditionally processed oils, entailing the fermentation of palm fruits prior to oil extraction had higher ffa content than the mechanically processed oils in which the fruits are sterilized soon after harvest. Such fermentation processes have been shown to encourage the growth of lipolytic moulds in such seeds (Coursey & Eggins, 1961; Broadbent & Kuku, 1977) with subsequent production of high ffa in oils extracted from such seeds. Free fatty acids are known to be produced as a result of fat-splitting reactions in which glyceride molecules combine with water to yield ffa and, in succession, diglycerides, monoglyceride and free glycerol.

Similarly, industrial application of palm oil prescribes 0–5 meq kg^{-1}, 0·10% and 0·01% as the acceptable limits for peroxide value, moisture content and impurity levels, respectively. Except for sample C, the peroxide values for the different processing methods were generally close to, or within, these ranges. The higher peroxide value, of the traditionally processed sample C, is attributable, in part, to the prolonged heating of the crude oil (Fig. 3) prior to clarification. The higher impurity levels of the traditionally processed oils than the mechanically processed sample is traceable, largely, to the crude clarification method of the former, which involves the use of hand-woven filters. The lower moisture content of the traditionally processed oils would appear to be related to the duration of boiling of the crude oil.

Generally, the various processing techniques brought about distinct variabilities in the parameters measured. In the main, the mechanically processed oil had better quality than the traditionally processed ones, especially with respect to the ffa and impurity levels. Consequently, it is suggested that the ffa levels of the traditionally processed oils may be reduced by discouraging or minimizing the fermentation time. This would entail the sterilization of the fruits soon after harvest to avoid lipolytic changes. The high level of impurities in the locally processed palm oil may be diminished by using cloth or other more efficient filtering aid rather than the hand-woven, frond-filters currently in use.

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