

## Evaluation of effects of extraction techniques on palm oil quality

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### Abstract

The evaluation of effect of extraction techniques on quality of extracted palm oil was investigated. The oil was extracted using three different methods namely: traditional method, semi-mechanized method and mechanized method. The oil was analysed using American Society for Testing Materials (ASTM) methods and compared the quality with standard specification for palm oil. In all the methods used, mechanized techniques gave highest oil yield of 30%. The result of the analysis showed that the method of palm oil extraction affects the quality and storage ability of the oil. The mechanized method gave oil with better quality. The poor quality of palm oil and rate of easily deterioration can be reduced by carrying out proper mechanization, improvement on semi-mechanized and eradication of traditional method of extraction.

**Keywords:** Palm oil, Extraction, Traditional method, Semi-mechanization method, Mechanized method

### 1. Introduction

The evaluation of effects of extraction techniques has been a serious problem militating against the production of quality palm oil, because the major extraction method that is prevalent by palm oil extractor are so crude, such that the palm oil produced will not stand the taste of time due to microbial growth.

Palm oil is a by-product that is orange-red to brownish or yellow-red in colour, extracted from the mesocarp of fruits of oil palm tree (*Elaeis guineensis jacq*). The shape of fruit is drupe, prolate spheroid varies from range of 20 to 50mm in length and the size varies as large as 20mm in diameter. They are found in bunches that are attached to the crown of the palm tree through the stalk and enable me to carry out this research process using two species of tenera and dura species. (Badmus, 1987) [2].

The fruit pulp from where the oil is obtained surrounds a nut, the shell of which encloses the palm kernel from which another oil, the palm kernel oil is obtained (Hartly, 1988) [4].

In obtaining the palm oil, the process involve include field operation which consist of harvesting, that covered cutting of bunch from the trees and allowing it to fall to the ground due to gravity, fruits may be damage in the process of pruning palm fronds to expose the bunch base to facilitate bunch cutting and the bunch falls to the ground to impact bruises to the fruits (Badmus 1987) [2]. The threshing or removal of fruits from the bunches consist of fruit embedded in spikelet growing on a main stem. So, manual threshing is achieved by cutting the fruit-laden spikelet from the bunch stem with an axe or matchet and then separating the fruit from the spikelet by hand (Badmus, 1990) [3].

The separated fruit will undergo sterilization or cooking by subjecting it to high temperature, wet-heat treatment. During this process, we used cooking process that involves the use of hot water and during sterilization we employed the techniques of pressurized steam (NIFOR, 1975) [5].

The digestion of fruit at the milling machines and squeezing of palm oil out of the digested fruit pulp depending on the

extracted method employed and the palm oil collected in a container. The acceptability of the palm oil collected, in the international market is largely dependent on the physiochemical properties of the oil of the time of purchase. Therefore, this work studied the evaluation of the effect of extraction techniques on the quality of palm oil.

### 2. Materials and Methods

#### 2.1 Material

The palm fruits were obtained from Amokwe village in Udi Local Government of Enugu and the experiment were carried out in Material and Energy Department.

#### 2.2 Extraction of palm oil

The oil was extracted using traditional, semi-mechanized and mechanized methods.

##### 2.2.1 Extraction using traditional method

Two ripe fresh fruit bunches of 10kg each was sectioned into spikelet with a cutlass and the heap formed was steam-heated in batches in an autoclave of about 121 °C for 60 minutes. The fruit were stripped with forceps and manually pounded in a mortar. Oil was manually squeezed out of the digested pulp mass after per-boiling it at a temperature of 40 °C. The oil obtained was clarified by decantation and filtering. The filtered palm oil was therefore boiled for 30 minutes at 70 °C to reduce the moisture content.

##### 2.2.2 Extraction using semi-mechanized methods

Two ripe fresh fruit bunches of 10kg each was sectioned into spikelet with a cutlass and the heap formed was steam-heated in batches in an autoclave of about 121 °C for 60 minutes. The fruit were stripped with forceps and digested with hot water raised digester. Oil was squeezed out of the digested pulp mass with hot water raised palm oil presser. The oil obtained was clarified by boiling and filtration using washman No. 1 filter paper. The filtered palm oil was therefore boiled for 30 minutes at 70 °C to reduce the

moisture content.

### 2.2.3 Extraction using mechanized methods

Two ripe fresh fruit bunches of 10kg each was steam-heated and thrown into a palm fruit stripper and the fruit were stripped. The fruits were charged in a digester. Oil was squeezed out of the digested pulp mass with hot water raised palm oil presser. The oil obtained was clarified by boiling and filtration using washman No. 1 filter paper. The filtered palm oil was therefore boiled for 30 minutes at 70 °C to reduce the moisture content.

### 2.3 Analysis of palm oil extracted using different methods

American Society for Testing Materials (ASTM) was employed to evaluate the physiochemical properties of the palm oil sample collected with regard to different extraction methods. Physiochemical properties determined are: iodine value, peroxide value, free fatty acid (FFA), moisture content, percentage impurity, density, microbial count, viscosity and colour.

## 3. Result and Discussion

### 3.1 Yield of oil

The yield of oil using the three methods is shown in Table 1 below. It could be observed that extraction using mechanized method gave higher yield this could be that oil loss was minimized by the process.

**Table 1:** Yield of oil from different extraction methods

S/No	Methods	Mass of oil (kg)	Yield (%)
1	Traditional	4	20
2	Semi-mechanized	5	25
3	Mechanized	6	30

### 3.2 Analysis of palm oil

Table 2 presents the result of freshly prepared palm oil obtained from different extraction methods and it could be observed that the effect of the method have remarkable effect on the quality of palm oil as their qualities decreased from semi-mechanized to traditional methods.

Table 3 is the result of palm oil obtained from different extraction methods and stored for long period of time (about six months), it demonstrated that effect of extraction method really affect the quality and storage ability of processed palm oil as it gradually deteriorate in quality and gradual change of taste.

From Table 4, the freshly processed palm oil under the mechanized extraction method has its quality equivalent to the specification of National Food and Drug Administration Control (NAFDAC) in conjunction with Standards Organization of Nigeria (SON) and American Oil Chemist Society, AOACs. Table 2, showed that the quality of palm oil produced through the mechanized aspect has advantage in terms of its quality and storage ability.

**Table 2:** Tabulation of Analysis of Freshly Processed Palm Oil

Palm oil sample	PV (ml/kg)	IV (ml/kg)	MC (%)	Impurity (%)	FFA (%)	Microbial count (cfu/ml)	Viscosity (g/ms)	Density (g/cm <sup>3</sup> )	Colour
Traditional method	35.50	39.48	2.16	7.95	27.45	9.10	3.62	0.99	25R <sub>1.5</sub> y
Semi-mechanized method	25.00	46.62	1.80	5.50	16.20	6.80	2.40	0.90	20R <sub>0.4</sub> y
Mechanized method	15.00	52.68	0.18	1.00	4.80	3.60	1.19	0.84	19R <sub>1.0</sub> y

**Table 3:** Tabulation of Analysis of Long time Stored processed Palm Oil

Palm oil sample	PV (ml/kg)	IV (ml/kg)	MC (%)	Impurity (%)	FFA (%)	Microbial count (cfu/ml)	Viscosity (g/ms)	Density (g/cm <sup>3</sup> )	Colour
Traditional method	41.00	32.46	5.10	9.50	28.40	11.00	4.25	1.00	22R <sub>2.6</sub> y
Semi-mechanized method	31.50	40.61	2.24	6.01	17.7	8.10	2.99	0.920	17R <sub>1.2</sub> y
Mechanized method	16.50	51.25	0.21	1.05	3.80	4.50	1.51	0.830	18R <sub>1.4</sub> y

**Table 4:** Standard for Palm Oil Specification

Free fatty acid (FFA)	3-5%
Peroxide value (PV)	30-50ml/kg
Iodine value (IV)	45-60ml/kg
Moisture content/impurities	1-5%
Colour	Red
Microbial count	3-4cfu/ml

Source: Asian agro Agungjaya, 2002

## 4. Conclusion

The method of palm oil extraction determine the quality and storage ability of the oil, as can be seen from the sample collected from Amok us, Udi Local Government Area of Enugu State, with regard to various extraction methods. It is imperative to understand that much engineering work needs to be done in respect to the drudgery nature of milling, poor quality of palm oil, rate of easily deterioration can be reduced

by carrying out proper mechanization, improvement on semi-mechanized and eradication of traditional method of extraction. It is clear to understand from this investigation, that for the National Food Security to compete with the international standards, we need to improve on every aspect of food processing, palm oil processing in particular. The storage ability of palm oil is the challenge facing agricultural mechanization of this state and Nigeria at large, is bestowed on Agricultural and Food Engineers.

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