# Biochemistry

# Preliminary Extraction And Characterization Of The Oil From Carapa Procera Seed

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## ABSTRACT

The seeds of the crabwood tree (Carapa procera L.) contain a high percentage of oil (over 60%) compared with other popular Ghanaian oil seeds. A preliminary investigation into the extraction and physical and chemical characterization of the oil has been carried out in order to determine its potential economic use.

Its characteristics are compared with those of some commonly used oils. A low moisture content of 9.40% was obtained with the fresh ground seeds. The oil has saponification and iodine values of 119-126 and 101.5, respectively. The interpretation of these results in relation to its possible economic use is given.

Keywords: carapa procera, characterization, iodine value, saponification value, oil content.

## INTRODUCTION

The prices of all the common edible oils on the Ghanaian market have been increasing steadily. One of the contributory factors to this trend is the competition between the industrial requirement for the oils and their use for edible purposes. This trend can be reversed if alternative sources of oils could be found purposely for industrial uses so as to relieve the stress on the common edible oils.

The crabwood tree (Carapa procera L.) is a quick growing tree that abounds in tropical forests, usually preferring swampy localities. The tree produces abundant seeds whose kernels are very oily. The oil content of the kernels have been reported to be up to 60% or more [1]. This oil has been reported to be very bitter and used in France for candle and soap making. However, no physical or chemical characterization of this oil has been reported. But in view of the fact that high amount of oil is obtainable from the seeds coupled with the abundant distribution of the tree in most forest zones of Ghana, a characterization of the oil to determine its potential economic use was considered desirable. This paper reports on the preliminary characterization carried out on the oil and discusses its possible industrial uses.

## MATERIALS AND METHODS

The seeds of the Carapa procera were collected on the University of Science and Technology. Kumasi campus at the horticulture section of Faculty of Agriculture. Seed collection was between March and April and these were stored in the refrigerator at 0-4° for about a year before use.

## OIL EXTRACTION

Prior to the extraction of the oil, the moisture content of the seeds was determined by drying ground samples to constant weight in an oven at 150°C.

Solvent extraction of the oil was carried out using the soxhlet method with petroleum ether (60° - 80°C) as the extraction solvent. Extraction was carried out on 10g samples of ground and moisture-free seeds.

## CHARACTERIZATION

Some physical and chemical properties of the extracted oil were determined to characterize it.

## PHYSICAL PROPERTIES

(1) Solubility Test: The solubility of the oil in different solvents was tested by adding 3ml of the test solvent to one drop of oil in a test tube. The test solvents used were ether, chloroform, petroleum ether, carbon tetrachloride, hot and cold acetone and 95% ethanol. The solubility of the oil in a particular solvent was ascertained using the translucency test for oils.

Moisture and Volatile Matter: This was determined by heating 0.31g of oil in an oven maintained at 105°C to a constant weight.

The specific gravity of the oil was determined by the conventional method at 20°C.

Chemical Properties: The properties determined on the oil were iodine number, saponification number, ester value and acid value each of which provides some specific information about the nature and quality of the oil.

Iodine Number: This determination was performed according to the method of Wij [2]. Saponification value was determined by the method of Kottstorfer [3].

The acid value of the oil was determined by titrating 0.5g of the oil in alcohol against 0.5N KOH using phenolphthalein as indicator.

The ester value was determined by calculating the difference between the saponification value and acid value.

## RESULTS

All results are averages of 3 determinations.

Table 1 shows the results of the various parameters determined on the oil.

The yield of oil as determined by solvent extraction was 62.25%. The seed has a moisture content of 9.40%. The oil itself had an iodine value of 101.52% and acid value of 32.20mg. The saponification and ester values were 122.50mg and 90.30mg respectively.

The specific gravity of the oil at 20°C was 0.95 03 and the total moisture and volatile matter was found to be 0.80%.

For the purposes of comparison, some of the characteristics of other popular oils are shown alongside that of Carapa procera in Tables 2 and 3.

TABLE 1: RESULTS ON THE CHARACTERIZATION OF THE OIL FROM SEEDS OF CARAPA PROCERA (Monkey cola)

| PARAMETER DETERMINED | VALUE |
|---|---|
| Moisture Content (Fresh ground seed) | 9.40% |
| Iodine Number | 101.52g |
| Saponification Number | 122.50mg |
| Ester Value | 90.30mg |
| Specific Gravity | 0.9503 |
| Moisture and Volatile Matter | 0.80% |

## DISCUSSION

Irvine [1] reported the oil content of Carapa procera seeds to be above 60% by any extraction procedure. The present results of a yield of 62.25% by solvent extraction thus confirms previous findings. The moisture content of the fresh seeds of 9.4% is relatively low

TABLE 2: MOISTURE AND OIL CONTENT OF SOME GHANAIAN OIL SEEDS [4]

| Oil Seed | Source | Moisture (%) | Oil Content (%) |
|---|---|---|---|
| Tiger Nut | Accra | | |
| a) Fresh | | 43.2 | 12.8 |
| b) Dried | | 9.6 | 21.5 |
| Mature Coconut | Accra | 43.5 | 36.3 |
| Palm Nut | Accra | | |
| a) Fresh Pericarp | | 30.0 | 46.8 |
| b) Kernel | | 18.0 | 43.5 |
| Groundnut | Northern Ghana | | |
| a) Raw with skin | | 6.0 | 48.5 |
| b) Roasted | | 2.3 | 50.5 |
| Shea Nut | Northern Ghana | 5.7 | 43.8 |
| Carapa Procera | Kumasi | 9.4 | 62.25 |

TABLE 3: PHYSICAL AND CHEMICAL CONSTANTS OF SOME OILS [5]

| Oil | Description | Specific Gravity | Iodine No | Saponification No | Acid Value |
|---|---|---|---|---|---|
| Linseed | Drying | 0.939-0.938 | 175 - 202 | 188 - 195 | 1.0 - 3.5 |
| Cotton seed | Semi-drying | 0.917-0.918 | 103 - 111 | 194 - 196 | 0.6 - 0.9 |
| Olive | Non-drying | 0.915-0.970 | 79 - 88 | 185 - 196 | 0.3 - 1.0 |
| Castor | Non-drying | 0.960-0.962 | 84 | 175 - 183 | 0.12- 0.8 |
| Coconu | Non-drying | 0.926 | 6 - 10 | 253 -262 | 1.1 - 1.9 |
| Cod Liver | Semi-drying | 0.927-0.931 | 137 - 166 | 171 - 189 | 5.6 |
| Palm | Non-drying | 0.924 | 49.2-58.9 | 200 - 205 | 10 |
| Carapa * procera | semi-drying | 0.950 | 101.52 | 119 - 126 | 30.8 - 33.60 |

*Determined in this work.

compared to some other oil seeds (Table 2). Thus with a moderate amount of drying the storage properties of the seeds can be greatly enhanced.

An iodine value of 101.52 (Table 1) indicates the oil has a high degree of unsaturation. The degree of unsaturation determines whether the oil can be classified as drying, semi-drying or non-drying. Oils with high iodine value and which dry up quickly on standing such as linseed oil are classified as drying oils while those with low iodine value are non-drying (Table 3). On the basis of this, the oil of Carapa procera is classified as semi-drying.

The saponification value of 119-126 obtained for the oil is low compared to those of other oil seeds (Table 3) This low saponification value may indicate the presence of substantial amounts of unsaponifiable matter. For this preliminary work however, the non-saponifiable matter content has not been determined.

From the industrial point of view, the Carapa procera oil will be suitable for soap making. Owing to limitations of equipment the fatty acid composition of the oil could not be determined. Thus it is not possible to ascertain from this work whether the oil will be more suitable for the manufacture of toilet soaps with good lathering properties or laundary soaps with good cleaning properties. In most soap manufacturing industries however, a blend of two or more oils is often carried out to attain the desired property for the soap. Thus the oil of Carapa procera could be used similarly. The advantage of blending Carapa procera oil with others for soap manufacture will be the reduction in production cost. This advantage stems from the high oil content coupled with its being not used for domestic purposes.

Secondly since the plant is quick-growing and widely distributed, there will be ready availability of seeds for oil extraction purposes. Thus at least the cottage industries could consider using this oil as an alternative in soap manufacture.

The seeds used for this analysis had been stored in the refrigerator for about one year before use. Rancidity had therefore started even before the oil was extracted. This certainly contributed to the high acid value obtained. However, the acid value which is an indication of the degree of rancidity of an oil is of significance only when the oil is to be used for edible purposes. It is not of so much significance if the oil is to be used for soap manufacture.

## CONCLUSION

The yield of oil from the monkey cola (Carapa procera L.) by solvent extraction was 62%. The properties of the oil indicate that it can be used indusrially in soap manufacture. Because of the high oil content, coupled with ready availability of oil seeds, the cottage soap industries should be encouraged to use this oil in order to abate competion with palm and coconut oils for the same purpose.

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