PATUA PALM OIL

(Oenocarpus Bataua, Mart)

By G. S. JAMIESON & R. S. McKINNEY

(Contribution from the Oil, Fat and Wax Laboratory, Bureau of Chemistry and Soils, U. S. Department of Agriculture)

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The patauá palm is also called batava, coumou, turu and mohi. The last name is also applied by the Indians of the Rio Negro to the palm Mauritia carana. In Brazil, the name "patauá" appears to be the one in more common use.

The patauá palm flourishes in the humid marginal forests along the Amazon and its tributaries, where it grows in groups, each of which usually contains many individuals. At maturity the palm reaches a height of 12 to 15 meters. The smooth, cylindrical trunk is about 20 centimeters in diameter. The leaves are pinnate and about 5 meters long. The leaflets are slightly more than a meter in length and 10 centimeters broad, ending in a point at the tip. The inflorescence, the sheaf of which is 1½ meters long, is similar to that of the royal palm. The single seed of the dark purple fruit is the size of a nutmeg and is densely covered with loose fibers. (The following general information on the genus Oenocarpus was taken from "Las Palmas de la Flora Venezolana," by Alfredo Jahn, Jr., and issued by the Universidad Central de Venezuela in 1908.

"Tall palms with unarmed ringed trunk, rarely with spines, leaves, terminal, pinnate; the segments rigid and sharp, pointed with recurved margins at base. Petiole short; inflorescence with short peduncle, borne below leaves; flowers monoecious; fruit almost spherical with a single seed and edible flesh. Eight species are found in forests of the Orinoco and Amazon Rivers").

The oil content of the kernel is about one per cent, whereas that of the flesh or pulp is reported to be about 11 per cent of the weight of the whole fruit. (F. W. Freise; Chem. Umschau *38*, 216, 1931.) In addition to the preparation of the oil, the fruits are used for making wine and a drink called "batava yuquiza."

Chemical and Physical

The present investigation was made on a large sample of patauá oil for which we are much indebted to Dr. J. B. De Moraes Carvalho, who is in charge of the Imstituto De Oleos, Department of Agriculture at Rio Janeiro, Brazil. The oil was expressed from fruits collected in the vicinity of Belem, State of Para. Although it was received during September, 1932, its examination was only recently undertaken. The oil was stored in well-filled bottles in a laboratory locker, and at the time the examination was made it appeared to be in excellent condition. The brilliant pale yellow oil, with a suggestion of green, has the appearance of virgin olive oil, and its characteristics are strikingly similar, a fact noted by many others. The solidification point, however, is much below that for any olive oil. According to previous investigations, the usual range is between —5° and —9°C.

For some years the oil has been produced commercially in the States of Para and Amazonas, and used for the same purposes as olive oil.

Table I gives the chemical and physical characteristics.

TABLE I

Specific gravity at 25°/25	0.9118
Refractive index at 25°	1.4662
Acid value	3.01
Iodine number (Hanus)	75.4
Thiocyanogen value	72.8
Saponification value	190.4
Reichert-Meissl value	0.33
Polenske number	0.19
Acetyl value (Andre-Cook)	10.4
Unsaponifiable matter, %	0.48
Iodine number of unsaponifiable	104.0
Saturated acids (corrected), %	14.45
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The percentage of saturated acids in this oil, calculated from the thiocyanogen value, was 14.31, which is in good agreement with that obtained (14.45) by the lead-salt ether method.

The iodine numbers reported by various observers for patauá oil range from 75 to 81.5. Most of these were determined according to the Hubl procedure.

Unsaturated Acids

From the iodine number of the oil and the percentage of unsaturated acids, the iodine number of the latter was calculated to be 92.1. With this number the proportions of oleic and linoleic acids were calculated, with the following results:

	Unsaturated Acids, %	In Oil, %
Oleic	95.69	76.54
Linoleic	4.31	3.40

Saturated Acids

The saturated acids, which were separated from the saponified oil by the lead-salt ether procedure, were esterified with anhydrous ethyl alcohol in the presence of dry hydrogen chloride gas. (J. Amer. Chem. Soc. *42*, 1200, 1920.) The esters (87.80 grams), freed from solvent and moisture, were fractionally distilled

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under a pressure of 4 mm. The four fractions, as well as the undistilled residue, were in turn redistilled from a 150-cc. Ladenburg fractionation flask. Five fractions were obtained, and from the results of their analyses the composition of each one was determined as previously described (J. Amer. Chem. Soc. *46*, 775, 1924). With these analytical data, the results given in Table II were calculated.

TABLE II

	Saturated Acids, %	Acids in Oil, %
Palmitic	60.83	8.79
Stearic	38.69	5.59
Triacontanic	.48	.07

The acids were recovered from the ester fractions and the very small undistilled residue by saponifying them with alcoholic potash and decomposing the soaps with hydrochloric acid. The acids were collected and completely separated from potassium chloride and the excess hydrochloric acid by remelting them with hot distilled water in the usual manner. The acids obtained from the various distilled ester fractions and the residue were fractionally crystallized from ethyl alcohol. The identity of the individual acids (palmitic and stearic) which were separated by this means was established in each case by their melting points and by observing whether or not these melting points were lowered when the acids were mixed with equal quantities of the respective acids, the composition of which had been determined by elementary analysis. There was no depression of the melting point in either instance. The acids isolated from the fractions in each case confirmed the deductions previously made from the mean molecular weights of the saturated acid esters.

As no myristic acid could be isolated from fraction one, 75.5 grams of the ethyl esters of the unsaturated acid fraction of the oil were prepared and fractionally distilled at a pressure of 5 mm. in an atmosphere of carbon dioxide. The acids were recovered from the first two of the ester fractions. These were analyzed and submitted to fractional crystallization from ethyl alcohol, but no myristic acid was obtained. However a few milligrams of palmistic acid were separated from the first fraction. After the removal of this acid, the filtrate was "seeded" with 2 mg. of crystals of myristic acid, but upon standing for three weeks at 10 to 15°C. no additional solid acid of any kind separated from the solution.

From the small undistilled residue of esters 0.200 gram of an acid was obtained which melted at 91-92°. Fraction five also contained 0.154 g. of this acid. By means of the neutralization value of the acid its molecular weight was calculated to be 468, indicating that it was largely composed of the acid $C_{30}H_{60}O_2$, having a molecular weight of 462.6. The acid used in this test was recovered, and a portion of it was converted into the ethyl ester. The acid and its ester were examined by the x-ray spectrophotometer method. The examination was made by Dr. S. B. Hendricks of the Nitrogen Fixation Laboratory, who has reported the following results:

The photographs for the acid showed "C" spacing 67.0 ± .5 A°, indicating a mixture of acids ($C_{29} + C_{31}$) approximately in equal proportions or a C_{30} acid with a small quantity of an acid of higher molecular weight. The ethyl ester gave a spacing 39.6 ± .2 A°, which corresponded to a C_{30} acid with a small quantity of an acid with a higher molecular weight. As this spacing was not enhanced it indicates that the acid was relatively pure. From these observations, the interpretations of which are based on the work of Francis, Piper and Malkin (Proc. Roy. Soc. A 128, 214 1930), Dr. Hendricks concludes that the substance in question is almost pure triacontanic acid ($C_{30}H_{60}C_2$) but contains a small quantity of some higher homologue.

It will be observed that this conclusion is in agreement with our molecular weight determination, to which reference has been made.

The composition of the oil in terms of glycerides is given in Table III.

TABLE III

Percentages of the Fatty Acids as Glycerides

Glycerides of:	*Per Cent*
Oleic acid	80.0
Linoleic acid	3.5
Palmitic acid	9.0
Stearic acid	5.8