Fixed Oils of Mexico. V. Mamey (Calocarpum mammosum L.)[1]

RODOLFO RUIZ MUNGUIA, RICARDO MILLARES, N. F. GURLEY, and W. R. LLOYD,
Armour Research Foundation, International Division, Mexico, D. F.

THE fruit of the Mamey [*Calocarpum mammosum* (*L.*) Pierre, family Sapotaceae] is well known in all the tropical regions of Mexico. The fruit is ovoid in shape, ranging from 300 to 600 grams in weight, and growing as large as 6 inches along the major axis and to 4 inches along the minor axis. The fruit is covered by a yellow to brown hard peel. Beneath the peel is the pulpy fruit, red in color, having a delicate, characteristic flavor. The fruit is cultivated for the pulp, which is eaten as a seasonal fresh fruit, either alone or with other fruits in cocktails and salads. Imbedded in the pulp is a large, ovoid seed, roughly 2 by 3 inches weighing from 30 to 90 grams. The kernel of the seed is covered by a hard, smooth, thin shell, brown in color, with a pebbled, grayish-white segment comprising roughly one-sixth of its area. The kernel within this shell is a yellowish white ovoid which can easily be split in half longitudinally. The kernel has a bitter flavor and gives off a strong odor of benzaldehyde similar to that of almonds (1).

The tree and fruit of the mamey are well described in the Mexican botanical literature (1). The tree is cultivated in various parts of Mexico and grows wild in most of the tropical areas of Mexico, Central America, and the Antilles.

Jamieson reports a study of the oil from mamey seeds obtained from Honduras (2). He reports the seeds as being 6 to 8 cm. long and 2 to 3 cm. in diameter at the largest point. These seeds of Jamieson were small and not typical of the seeds from the more highly prized cultivated varieties; they even appear small as compared to many of the wild varieties which have been encountered in Armour Research Foundation field work. Jamieson reports a yield of 57% oil and the following constants:

Specific Gravity 25/25	0.9105
Refractive Index	1.4652
Saponification Number	189.5
Iodine Number	70.2
RMV Value	0.15
Polenske Value	0.30
Acetyl Number	12.2
Unsaponifiables	1.39
Saturated Acids	30.37
Unsaturated Acids	63.73
Oleic Acid	52.15
Linoleic Acid	12.88
Palmitic Acid	9.4
Stearic Acid	20.95
Arachidic Acid	0.02

The mamey is also known by the following names in Mexico: "zapote"; "zapote mamey"; "zapote colorado"; "mamey colorado"; "haaz"; "chacal haaz." Several other fruits are also known as "zapotes," but as the more common name for C. mammosum is mamey, no real difficulty is caused by this similarity in names. However, in Southern Mexico, the term mamey is frequently applied to "Mammea americana," and care must be exercised in this region to avoid confusion.

[1] Extract from laboratory studies of Mexican Natural Resources as part of the Mexican industrial development program conducted by the Armour Research Foundation of Illinois Institute of Technology under the sponsorship of the Banco de Mexico, S. A. This series of papers reports the results of investigations designed to establish the properties and characteristics of various native Mexican oils which are not, at present, produced on a commercial scale.

Experimental

The sample of fruit used in these studies was purchased in the market in Mexico City, having been grown in Guerrero, and was of a large extra-fine variety. The seeds were removed from the fruit, the shell of the seed removed, and the kernels air-dried. The dried kernels were then ground in a Wiley mill and further dried to remove their natural moisture. Quantitative extractions were then made in Soxhlet extractors using petroleum ether (B.P. 30°-60°C.). Triplicate determinations gave a yield of 49.9% oil based on the dry weight of kernels.

Samples of oil extracted by petroleum ether were a pale yellow in color, with an almond-like odor and a slightly bitter taste. On standing at room temperature, the oil remained fluid for several weeks before depositing any stearin-like solids; but on slight cooling the entire oil solidified and remained solid at room temperature. The odor and taste of the oil are undoubtedly due to the presence of amygdalin or an amygdalin-like glycoside.

The physical characteristics of the oil were determined by A.O.C.S. Methods (3) and the results are given in Table I.

TABLE I

Physical Characteristics of Oil From Mamey Seeds

Specific Gravity 25/25	0.9128
Refractive Index $N_{\frac{1}{2}}^{D}$	1.4690
Melting Point	8.0°C.
Melting Point of Fatty Acids	46.6°C.

The chemical characteristics of the oil were determined by A.O.C.S. Methods (3) and the results reported in Table II.

TABLE II

Chemical Characteristics of Oil From Mamey Seeds

Saponification Number	188.4
Acid Number	1.41
Unsaponifiables	1.83
Iodine Number (Wijs 1 hr.)	73.5
Thiocyanogen Number	54.1
Acetyl Number	10.9
Saturated Fatty Acids	36.87

The composition of the oil was calculated from the iodine and thiocyanogen numbers according to A.O.C.S. Methods (3). The results are reported in Table III.

TABLE III

Composition of Oil of Mamey (%)

Linoleic Acid as Glycerides	23.8
Oleic Acid as Glycerides	37.5
Saturated Glycerides	36.8
Unsaponifiables	1.8

The composition of the saturated fatty acid fraction will be reported in a subsequent paper.

Discussion

The oil of the mamey seed is an important potential source of high quality vegetable oil for soaps and cosmetics as well as for other uses. At the present time, with the major part of the mamey crop being used as a fresh fruit for domestic consumption, it is impractical to collect the seed for oil production. While some unsuccessful attempts have been made to preserve the fruit, it is entirely possible that such a process will be developed, and in this event considerable quantities of otherwise useless waste product will be available for oil production from the seed. In addition, there is a substantial amount of wild mamey in various parts of Mexico that could be gathered for oil production from the seed. The tree is reputed to yield from 100 to 200 fruits per season. This yield, in view of the relatively high unit weight of the seed and its high oil content, makes the production of the oil from wild plants more feasible than from many other wild oil-bearing seeds, especially in those areas where the trees are not too widely scattered. Another possible source of the oil is from culls and overproduction in those areas now cultivating mamey for the fruit markets.

Summary

The physical and chemical characteristics of the oil of the fruit of the mamey [*Calocarpum mammosum* (*L.*) Pierre] have been reported.

The composition of the oil has been calculated.

REFERENCES

1. Martinez, Maximino: "Plantas Utiles de Mexico," Ediciones Botas, 2nd Ed., Mexico, D. F. (1936).

2. Jamieson, G. S.: "Vegetable Fats and Oils," 2nd Ed., Reinhold Publishing Corp., N. Y. (1943) p. 93.

3. Official and Tentative Methods of the American Oil Chemists' Society, 2nd Ed. (1946) A.O.C.S.

Modification of the Laboratory Centrifuge Method for the Determination of Refining Loss of Soybean Oil*

J. F. JOHNSON and S. T. BAUER, Research Laboratories, The Drackett Company, Cincinnati, Ohio

COMMERCIAL refining of oils by the centrifugal method has given ample evidence of higher efficiencies and yields over the batch method. Difficulties encountered in the refining of certain extracted soybean oils by the Official A.O.C.S. cup method have stimulated considerable research and investigation on the development of a laboratory centrifugal method which would give results comparable to those obtained from commercial operations.

Most of the work has been done by the Refining Committee of the A.O.C.S. and through the efforts of this committee a number of centrifugal methods have been proposed and studied. The centrifugal method was an obvious choice because it permits compacting the soap stock, thus overcoming the effect of watery or sloppy foots, and results in efficient draining of the clear oil. The first proposal of a laboratory centrifugal method was that presented by the Swift and Company Research Laboratories (1). They reported the use of a centrifuge in refining tests as an aid in obtaining quicker and better separation of the foots. Refinings were made in accordance with the tentative cup method. A portion of the oil-foots mixture was then poured into a pear-shaped container and the container swirled in the centrifuge to settle and compact the foots. The clear oil was drained and weighed. The report of the Refining Committee 1941-1942 (2) covered a complete study of a modification of the suggested method. Much of this work was done by the Regional Soybean Laboratory which recommended the use of 30° Bé alkali in five times the theoretical amount necessary to neutralize the free fatty acid. The high Baume lye was considered necessary to avoid water in the oil to even a greater extent than when gravity settling was used. Refining was done in the bronze centrifugal trunion cups using the regular refining bath apparatus. Stirrer blades were cut to permit insertion into the cups and a wooden yoke fashioned to secure the cups in place. The oil was freed from the foots by centrifugation at 2,800 R.P.M. in an International Centrifuge size 1, Type SB.

This method was tested on six solvent extracted oils at the Regional Soybean Laboratory and two of these oils (No. 3 and No. 4) sent out as collaborative samples to six independent laboratories. Their results are tabulated in the committee's report. Conclusions drawn from the collaborative work are summarized as follows: "Inspection of the results reveals that neither of the samples tested caused the type of difficulty often encountered with the A.O.C.S. method with solvent extracted oils. For this reason they cannot be considered the most stringent test of the method as far as overcoming the difficulties of soft or sloppy foots. On sample No. 3 only three out of six laboratories checked well by the centrifugal method while all six agreed when the A.O.C.S. method was used. On sample No. 4 four out of six agreed well by the centrifuge method and with the A.O.C.S. method four out of six agreed well." Conclusions in the report were: "These results certainly do not constitute any overwhelming argument in favor of the centrifuge method. However, consideration should be given to the fact that the A.O.C.S. method is familiar and more standardized while the proposed method was being carried out for the first time with improvised equipment and unavoidable variations in cups and centrifuging."

The report of the Refining Committee (3) for 1942-1943 gives the results up to that date on work outlined at the previous meeting held April 24, 1940, at the Regional Soybean Products Laboratory. The report presents data on the refining of 12 oils by both the centrifugal and A.O.C.S. official methods. The statement is made that the centrifugal method has given firm foots for all oils and offers a sure

* Presented at 22nd fall meeting, American Oil Chemists' Society, New York City, Nov. 15-17, 1948.