[CONTRIBUTION FROM THE OIL, FAT AND WAX LABORATORY, BUREAU OF CHEMISTRY, DEPARTMENT OF AGRICULTURE.]

CANTALOUP SEED OIL.

BY WALTER F. BAUGHMAN, DIRK BRAUNS, AND GEORGE S. JAMIESON.

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Considerable quantities of unmarketable cantaloup (*Cucumis melo* L.) are allowed to remain on the fields. If the melons are collected and dumped into shallow pits, they soon decompose so completely that the seeds can readily be recovered by raking them from the pits.

A large sample of cantaloup seed was received from the Imperial Valley, California. An ether extraction showed that these seeds contained about 30.4% of oil. The seeds were pressed by H. S. Bailey, formerly in charge of this laboratory, in an expeller, and the oil was used for this investigation, the results of which are given below.

Physical and Chemical Examination.—The cold-pressed virgin oil has a pale yellow color, an odor resembling that of olive oil and a pleasant fruity taste. The physical and chemical characteristics are given in Table I. The iodine number indicates that it might be a semi-drying oil, but no film developed even after the oil had been exposed to the air on a glass plate for one week. The acetyl value indicates the presence of a small amount of hydroxylated acids. Glycerides of volatile acids are almost completely absent as shown by the low Reichert-Meissl and Polenske numbers. Only 0.4% of acids soluble in water was found. The oil does not easily become rancid. This sample had been stored for 2 years at room temperature in a stoppered-glass bottle yet it had acquired no rancid odor nor taste and the acid value (mg. of potassium hydroxide required to neutralize the free acids in one g. of oil) was only 0.43. The saturated and unsaturated acids were determined by the lead-salt ether method. It is well known that it is not possible to effect a complete separation by this procedure. The saturated acid fraction always absorbs some iodine showing the presence of unsaturated acids. Also the unsaturated acid fraction is contaminated with small amounts of saturated acids, but this error is much smaller than the first. By refraining from excessively washing the precipitated lead salts of the saturated acids with ether the error caused by their slight solubility in ether is reduced. Of course, the amount of unsaturated acids remaining with the saturated acid fraction is greater. However, the amount can be calculated and the proper correction made as follows: $\frac{\text{iodine number of saturated acid fraction}}{\text{iodine number of unsaturated acid fraction}} \times 100 = A$ (per cent. of unsaturated acids contaminating the saturated acid fraction). The proper correction is then obtained by means of the formula $(A \times B)/100$ in which B is the per cent. of impure saturated acids. This correction

is subtracted from the per cent. of impure saturated acids and added to the per cent. of unsaturated acids actually determined.

TABLE I.—CANTALOUP SEED OIL.
Chemical and Physical Characteristics.

Specific gravity 25°/25°	0.9210
Refractive index 20°	1.4725
Iodine number (Hanus)	125.9
Saponification value	192.3
Reichert-Meissl number	0.33
Polenske number	0.26
Acetyl number	15.8
Acid value	0.43
Unsaponifiable matter, %	1.1
Soluble acids (% butyric acid)	0.4
Insoluble acids %	94.0
Unsaturated acids (determined) %	79.2 (Iodine No. 151.8)
Saturated acids (determined) %	15.3 (Iodine No. 10.0)
Unsaturated acids (corrected) %	80.2
Saturated acids (corrected) %	14.3

Unsaturated Acids.—The bromine addition derivatives[1] of the unsaturated acids were made. No hexabromide was obtained, which indicates the absence of linolenic acid. A large quantity of linolic tetrabromide was obtained melting at 113–114°. The theoretical iodine number of linolic acid is 181.4 while the iodine number of the unsaturated acid fraction is 151.8; so oleic acid whose iodine number is 90.1 must also be present. Using the iodine numbers to calculate the proportions of these 2 acids we get 67.6% of linolic acid and 32.4% of oleic acid in the unsaturated acid fraction, or 56.6% of the glyceride of linolic acid and 27.2% of oleic acid glyceride in the original oil.

Saturated Acids.—The saturated acids obtained by the lead salt ether method were esterified with methyl alcohol. The mixture of methyl esters was subjected to fractional distillation under diminished pressure. The data of this distillation are given in Table II. As indicated, a preliminary distillation resulted in 5 fractions designated by letters, and a residue. Fraction A was redistilled into Fractions 1, 2 and 3. Fractions B and C were combined and redistilled, resulting in Fractions 4, 5 and 6. Fraction D was not redistilled but E was combined with the original residue and redistilled into Fractions 8, 9 and 10

The iodine numbers and the saponification values of the various fractions are given in Table III, Cols. 2 and 3. From this data it is possible to calculate the saponification values and mean molecular weights of the saturated acid esters uncontaminated with unsaturated acid esters as explained in previous papers.[2]

[1] Lewkowitsch, "Chemical Technology and Analysis of Oils, Fats and Waxes," 5th Ed., Vol. I, pp. 568–578.

[2] THIS JOURNAL, 42, 152, 1197 (1920).

TABLE II.—CANTALOUP SEED OIL.
Fractional Distillation of Methyl Esters of Saturated Acids.
85.5 G. of Esters subjected to Distillation.

Original fractions.	Final fractions.	Temperature, ° C.	Pressure. Mm.	Weight. G.
A		165–165.5	4.0	(23.3)[a]
	1	165–169	6.0	3.3
	2	168–173	5.0	18.2
	3	175–176	5.0	1.8
B		165–167	4.0	(23.8)[a]
C		167	3.5	(8.4)[a]
	4	158–163	3.0	3.9
	5	164–166	3.0	21.8
	6	167–175	3.5	6.5
D	7	167–171	3.5	11.0
E		171–186	3.5	(15.2)[a]
Residue				(3.8)[a]
	8	179–183	3.0	13.4
	9	183–195	3.0	3.0
	10	195–220	3.0	1.0
	Residue			1.5
			Total.....	85.4

[a] Not included in total.

In Col. 6 are given the mean molecular weights of the methyl esters of the saturated acids in the various fractions. Inspection of these results indicates the possible saturated acids that may be present. The molecular weights of Fractions 1 and 4, 262.6 and 266.4 are between the molecular weight of methyl myristate (242.3) and methyl palmitate (270.3) and suggest, therefore, the presence of these 2 acids. The molecular weights of all the other fractions lie between methyl palmitate and methyl stearate (298.4).

The following acids were isolated and identified by recovering the free acids from the various fractions and subjecting them to fractional crystallization from alcohol until constant melting points were obtained.

Stearic acid, $C_{18}H_{36}O_2$, m. p. 69°. Several recrystallizations of the free acids recovered from Fractions 9 and 10 gave a product which melted at 68–69°. An elementary analysis was made with the following results:[1]

Calc. for stearic acid: H, 12.76; C, 75.98. Found: H, 12.50; C, 76.04.

Palmitic acid, $C_{16}H_{32}O_2$, m. p. 62.6°. From Fractions 1 and 2 acids were isolated having a melting point of 62–63°. Elementary analysis gave the following results:

Calc. for palmitic acid: H, 12.58; C, 74.92. Found: H, 12.47; C, 74.72.

Myristic acid, $C_{14}H_{28}O_2$, m. p. 53.8. The Fraction 1, alcoholic mother-liquor from the palmitic acid crystallization, was diluted with a small amount of water and a crop of crystals obtained which, after several

[1](Analysis by Charles E. F. Gersdorff.)

recrystallizations, melted at 54°. The fraction was not large enough for an elementary analysis.

It is now established that the saturated acids present are myristic, palmitic and stearic and the proportions present in each fraction have been calculated from the molecular weights with the results given in Table III.

TABLE III—CANTALOUP SEED OIL.

Results of Analyses of Fractions Obtained by Distilling Methyl Esters of Saturated Acids.

Fractions.	Iodine number.	Saponification value.	Unsaturated acids.		Mean molecular weight of esters of saturated acids.	Myristic acid.		Palmitic acid.		Stearic acid.	
			%	G.		%	G.	%	G.	%	G.
1.....	6.2	212.6	4.1	0.14	262.6	24.9	0.82	66.1	2.18	....	....
2.....	8.5	204.9	5.6	1.02	272.6	....	....	82.3	15.00	7.4	1.35
3.....	20.8	197.2	13.8	0.25	282.9	....	....	44.9	0.81	36.8	0.66
4.....	6.5	209.7	4.3	0.17	266.4	12.6	0.50	78.3	3.05	....	....
5.....	10.3	203.8	6.8	1.48	274.1	....	....	76.5	16.68	12.1	2.64
6.....	20.8	197.2	13.8	0.90	282.9	....	....	44.9	2.92	36.8	2.39
7.....	20.7	196.9	13.8	1.52	283.5	....	....	43.2	4.75	38.6	4.25
8.....	26.1	192.5	17.3	2.32	291.0	....	....	20.4	2.73	57.9	7.76
9.....	27.3	190.9	18.1	0.54	293.9	....	....	12.1	0.36	65.5	1.96
10.....	31.5	189.1	20.9	0.21	297.5	....	....	2.1	0.02	72.8	0.73
							1.32		48.50		21.74

Table IV gives in Col. 2 the percentage composition of the saturated acid fraction, in Col. 3 the percentages present in the original oil, and in Col. 4 the percentages of glycerides in the original oil.

TABLE IV.—CANTALOUP SEED OIL.

Composition of Saturated Acids.

	G.	%	Original oil. %	Glycerides in original oil. %
Myristic	1.32	1.8	0.3	0.3
Palmitic	48.50	67.8	9.7	10.2
Stearic	21.74	30.4	4.3	4.5
Total	71.56	100.0	14.3	15.0

Summary.

A sample of cantaloup seed was found to contain 30.4% oil. The chemical and physical characteristics of the oil were determined. A study was also made of the chemical composition, the results of which are given in the following table.

COMPOSITION OF CANTALOUP SEED OIL.

Glycerides of	Myristic acid	0.3
	Palmitic acid	10.2
	Stearic acid	4.5
	Oleic acid	27.2
	Linolic acid	56.6
Unsaponifiable matter		1.1
		99.9

WASHINGTON, D. C.