• Letter to the Editor

Composition of Food Fats and Oils

THERE HAS BEEN an increasing amount of interest in the past several years in the fatty acid composition of the various fats that may become part of our national diet. It is surprisingly difficult for one not thoroughly familiar with fat technology and analytical principles to obtain information of this sort that can be considered truly representative of commercially available raw materials and finished products. Confusion arises from the facts that a) much of the data in the literature, especially for polyunsaturated acids, are based on outmoded and unreliable methods of analysis, and b) many of the analyses reported were obtained on atypical samples that were not at all representative of the fats of commerce.

In order to assemble data that are more truly representative, the members of the Technical Committee of the Institute of Shortening and Edible Oils Inc. searched the records of their own laboratories for analyses of various food fats and raw materials that are used and/or produced by their companies. Only those data for polyunsaturated acid content which were obtained by spectrophotometric analysis were reported. Total monounsaturated acids reported as oleic, were calculated from the iodine value and the polyunsaturated analysis; total saturated acids were obtained by difference rather than by direct analysis. The proportion of the glycerides of each fat estimated by dilatometry to be solid at 70°F. and 90°F. (by extrapolation from the standard curve) were also reported. All analyses were based on the "Official and Tentative Methods" of the American Oil Chemists' Society.

TABLE III

Composition and Analytical Characteristics of Some Other Vegetable Oils Not Normally Used in Foods in the U.S.A.

	Linseed oil	Palm oil	Palm kernel oil	Rape-seed oil	Saf-flower oil	Sesame oil
Composition						
Oleic acid (%)[a]	31 – 36	34 – 56	14[c]	59 – 62[d]	10 – 23	35 – 47
Linoleic acid (%)[b]	8 – 21	10 – 11	2.3[c]	15	69 – 78	40 – 44
Linolenic acid (%)[b]	42 – 50	0.1 – 0.4	......	9 – 10	0 – 2	0 – 0.3
Arachidonic acid (%)[b]	......	......	......	......	......	......
Total saturated acids (%)	0 – 6	34 – 50	84[c]	14 – 16	5 – 13	12 – 16
Analytical characteristics						
Iodine value	181–192	51 – 58	16 – 18	103–109	141–150	109–115
Melting point (FAC) (°F.)	......	103–105	84 – 86	......	......	......
Solids index at 70°F	......	11 – 13	31 – 33	......	......	......
Solids index at 90°F	......	6 – 8	......	......	......	......

[a] Total monounsaturated acids.
[b] By spectrophotometric analysis.
[c] Only one analysis available.
[d] Mostly erucic.

A summary of the data collected is shown in Tables I, II, and III. It was agreed that it should be a useful service to make these data available to others *via* publication. We believe two points are especially noteworthy. a) There is a sizeable degree of variability in the composition of natural fats and oils as well as in the food fats and oils made from them. Therefore research workers should not rely on liter-

TABLE I

Composition and Analytical Characteristics of Principal Classes of Food Fats and Oils of the U.S.A.

	Household shortenings		Commercial bulk shortenings		Margarine oils	Cottonseed salad oils	Liquid shortenings
	Vegetable fat	Meat fat and vegetable fat	Vegetable fat	Meat fat and vegetable fat			
Composition							
Oleic acid (%)[a]	53– 75	37– 57	45– 76	40– 65	42– 79	17– 36	18– 45
Linoleic acid (%)[b]	3– 14	6– 13	3– 13	3– 13	2– 18	42– 55	30– 47
Linolenic acid (%)[b]	0– 0.5	0– 0.6	0– 0.7	0– 0.8	0– 0.4	0– 0.7	0– 1.0
Arachidonic acid (%)[b]	0	0– 0.5	0	0– 0.5	0	0	0
Total saturated acids (%)	16– 31	30– 50	15– 40	28– 40	12– 24	18– 30	17– 36
Analytical characteristics							
Iodine value	70– 81	54– 74	65– 90	55– 67	68– 83	107–117	90–104
Melting point (FAC) (°F.)	108–125	114–129	103–124	110–125	90–106	......	86–126
Solids index at 70°F	15– 30	16– 28	16– 26	19– 30	11– 21	......	2– 7
Solids index at 90°F	10– 20	10– 22	7– 21	7– 21	1– 7	......	0.5– 5

[a] Total monounsaturated acids. [b] By spectrophotometric analysis.

TABLE II

Composition and Analytical Characteristics of the Principal Animal and Vegetable Fats and Oils Used in Foods in the U.S.A.

	Beef fat	Butter fat	Coco butter	Coconut oil	Corn oil	Cottonseed oil	Lard	Olive oil	Peanut oil	Soybean oil
Composition										
Oleic acid (%)[a]	35 – 45	30– 32	34 – 38	6 – 9	25 – 37	17 – 37	47 – 83	62 – 83	30 – 58	16 – 47
Linoleic acid (%)[b]	0.5 – 3	1.0– 2.5	3 –3.5	1 – 4	50 – 56	44 – 55	7 – 13	8 – 15	21 – 37	39 – 53
Linolenic acid (%)[b]	0.2 – 0.6	0.2– 0.5	0.1–0.2	0 – 0.1	0.1 – 0.7	0 – 0.6	0.2 – 1.4	0.5–0.7	0 –0.5	4 – 9
Arachidonic acid (%)[b]	0.05– 0.2	0.2– 0.4	......	......	......	......	0.2 – 0.4	......	......	......
Total saturated acids (%)	45 – 58	63– 68	57 – 61	86 – 91	9 – 15	17 – 31	29 – 37	9 – 22	16 – 26	5 – 24
Analytical characteristics										
Iodine value	38 – 44	30– 40	37 – 44	8 – 15	122–125	103–112	63 – 69	76 – 88	90 – 99	125–131
Melting point (FAC) (°F.)	116–121	97–100	86 – 95	79 – 82	......	......	99 –112	......	......	......
Solids index at 70°F	23 – 30	11– 13	47 – 49	19 – 27	......	......	17 – 21	......	......	......
Solids index at 90°F	18 – 24	2.5– 4	0	0	......	......	4 – 6	......	......	......

[a] Total monounsaturated acids. [b] By spectrophotometric analysis.

ature data for the analysis of fat and oil samples they may be using in their work but should themselves obtain an analysis on each sample used. b) Contrary to the opinion apparently held by many research people, the data show that fats that are often referred to as "solid" or "saturated" are in fact predominately liquid or unsaturated. For example, only 11–21% of the glycerides of margarine are solid at room temperature, the remaining 79–89% being liquid. Similarly 70–85% of the glycerides of shortenings are in the liquid state at room temperature.

It should be added that even as this is being written, the knowledge of fatty acid composition of fats and oils is moving forward at a pace so accelerated by the recently developed technique of vapor phase chromatography that much of the data contained herein may soon be obsolete.

Technical Committee, Institute of Shortening and Edible Oils Inc., 1145 19th street, N.W., Washington, D.C.

V. K. BABAYAN
W. M. COCHRAN
F. J. COUGHLIN
W. A. JACOB
J. D. JUSTICE
S. J. RINI
H. D. ROYCE
H. T. SPANNUTH
R. J. VANDER WAL
K. F. MATTIL, chairman

December 24, 1958

ABSTRACTS . . . . R. A. REINERS, Editor

ABSTRACTORS: Lenore Petschaft Africk, R. R. Allen, S. S. Chang, Sini'tiro Kawamura, F. A. Kummerow, and Dorothy M. Rathmann

• Fats and Oils

DEACIDIFICATION WITH UREA OF PEANUT OILS OF LOW AND MEDIUM ACIDITY. M. Louty (Inst. tech. Corps Gras, Paris). *Olearia* 11, 213–17 (1957). Peanut oils with acidity of 1, 2.2, 3.5, 5, 10, and 15% were agitated at room temperature with varying amounts of urea and water. Optimum conditions were with urea at five times the fatty acid content of the oil and water at 45–60% of the urea used. Urea micella from one run with additional urea is used on the following run. Addition of water and centrifuging are used to separate final products. Satisfactory results are obtained when acidity is 1–5%. Below 1% the reaction decreases and above 5% greater difficulty in centrifuging is encountered. The method is economical but it does not deacidify completely. (*C.A.* **53**, 1785)

PREPARATION OF MONOGLYCERIDES FROM OLIVE OIL BY GLYCEROLYSIS IN THE PRESENCE OF UREA. R. Rigamonti and Amelia Vacirca (Turin Polytech. Italy). *Olearia* 12, 49–52 (1958). Olive oil 20, glycerol 10, potassium hydroxide 0.28, urea 100 parts, and a solvent are agitated at room temperature 6–28 hours. The solvents used are acetone at 80% of total volume, isopropanol 170 ml., and a 1:1 mixture of the two, 200 ml. After 23 hours the first yields 73% esters containing 41% monoglycerides; after 19 hours, the second, respectively, 64.5 and 53.0; and after 5 hours, the third, 97.5% and 61.9%, and after 22 hours, 99% and 54.17%. Yield of monoglycerides is not above 62% because the di- and tri-glycerides are occluded in the precipitate formed. The acetone acts only as a solvent while the isopropanol enters into the esterification reaction. (*C.A.* **53**, 1785)

USE OF TRICHLOROETHYLENE IN PROCESSING OLIVE PULP. M. Catalano (Univ. Bari, Italy). *Olearia* 11, 257–61 (1957). The results from hot and cold trichloroethylene extractions of olive pulp with and without moisture are tabulated. In cold extraction of the pulp containing moisture, oil yield is 1% greater than when the pulp is free of moisture; but impurities in the oils are, respectively, 7.23 and 6.54%. Hot extraction increases the impurities to about 12.4 and 11.3% from moist and dry pulp, respectively. (*C.A.* **53**, 1785)

BLEACHING OF VEGETABLE OILS. B. Ya. Sterlin. *Trudy Vsesoyuz. Nauch.-Issledovatel. Inst. Zhirov* **1954**(15), 105–13. Bleaching test results on cottonseed and rapeseed oils with domestic activated bleaching earths (gumbrin, askanite, tripolite) are given. Recommendations are given on pressing technique for cottonseed oil to lower color caused by gossypol derivatives. The use of bleaching earths is recommended also for bleaching of rapeseed oil in place of acid refining. (*C.A.* **53**, 1785)

THE FOUR TEMPERATURES TEST. IV. WINTERIZATION AND IDENTIFICATION OF OILS. G. B. Martinenghi. *Olearia* 12, 97–9 (1958); *ibid.* 11, 126–12 (1957). The four temperatures at which an oil becomes, respectively, cloudy, immobile, fluid, and clear are used to identify the oil. Data from nineteen samples show these points are about the same for refined oils from the same source, provided the oil has not been through the winterization process. The refined oils must be neutral and composed entirely of their particular glycerides. (*C.A.* **53**, 1784)

MODERN TECHNOLOGY OF FATS AND FATTY PRODUCTS. LI. THE COMMINUTION OF RAW MATERIALS. H. P. Kaufmann and J. G. Thieme (Inst. f. Fettforschung, Münster, Ger.). *Fette, Seifen, Anstrichmittel* **60**, 570–8 (1958). (*C.A.* **53**, 1784)

OILSEEDS. B. Y. Rao (Central Food Technol. Research Inst., Mysore, India). *Lit. Rev. Oils & Fats* **1956**, 1–4 (Pub. 1958).

PROCESSING OF OILS AND FATS. *Ibid.* 10–26.

CHEMISTRY, CHARACTERISTICS, COMPOSITION, AND ANALYSIS OF OILS AND FATS. *Ibid.* 27–55.

SPOILAGE. *Ibid.* 56–62.

NUTRITION AND METABOLISM. *Ibid.* 63–72. (*C.A.* **53**, 1784)

APPLICATION OF SPECTROPHOTOMETRY IN THE STUDY OF VEGETABLE OILS. F. Minutilli. *Rass. chim.* **10**(3), 24–7 (1958). A review, predominantly of French and U.S. literature, with 101 references. (*C.A.* **53**, 1784)

APPLICATION OF THE TRICHROMATIC TECHNIQUE FOR THE STUDY OF THE BLEACHING OF FATS WITH EARTHS. INFLUENCE OF THE TREATMENT ON CERTAIN PROPERTIES OF THE BLEACHED PRODUCTS. C. Trizis and A. Uzzan (Iterg, Paris). *Rev. franç. corps gras* **5**, 499–514 (1958). Two tallows and two lards were treated 30 minutes with 0.1, 0.2, 1.0% of different bleaching earths at 60, 80, 100°. The decrease of the color was determinted by the trichromatic method. Increasing the amount of bleaching earths is more efficient than increasing the temperature. (*C.A.* **53**, 1784)

A RAPID DETERMINATION OF THE HYDROXYL NUMBER. V. Vasilescu. *Fette, Seifen, Anstrichmittel* **60**, 541-4 (1958). The conventional method for the determination of the hydroxyl number of fatty alcohols, acids, and carbohydrates is shortened from 60 to 10 minutes by increasing the temperature of acetylation from 105 to 130–50°. The accuracy is not affected. (*C.A.* **53**, 1784)

THE SEPARATION OF HIGHER FATTY ACIDS BY PAPER CHROMATOGRAPHY WITH THE USE OF CHANGE OF SOLVENT CONCENTRATION DURING DEVELOPMENT. V. Palo, V. Koman, and Z. Hrabe (Slovenská vysoká škola tech., Bratislava, Czech.). *Chem zvesti* **12**, 525–32 (1958) (German summary). The method and results of separation of higher fatty acids by paper chromatography by using continuous change of mobile phase are described. It was possible to accomplish the separation on the whole width of the Whatman 3 filter paper with any number of samples. (*C.A.* **53**, 1783)