☆ ☆ ☆ ABSTRACTS ☆ ☆ ☆

Oils and Fats

Edited by
M. M. PISKUR

A NEW METHOD FOR THE COLORIMETRIC DETERMINATION OF THE TOTAL ESTERIFIED FATTY ACIDS IN HUMAN SERA. F. C. Bauer and E. F. Hirsch (Univ. Chicago). *Arch. Biochem. 20,* 242-50(1949). This is based on the conversion of the fatty acid esters to hydroxamic acids and the subsequent development of colored ferric salts.

n-EICOS-11-ENOIC ACID. C. Y. Hopkins, M. J. Chisholm, and J. Harris. *Can. J. Res. 27B,* 35-41(1949). Natural sources of *cis-n*-eicos-11-enoic acid, a convenient method of isolating the acid, and its conversion to the *trans*-form are described. It was found that the principal eicosenoic acid of a sample of Atlantic cod liver oil *(Gadus callarias)* was the 11-isomer, in contrast to the reports of other workers who investigated Pacific codfish and found only the 9-isomer.

STUDIES ON THE TOXICITY OF PROPYL GALLATE AND OF ANTIOXIDANT MIXTURES CONTAINING PROPYL GALLATE. J. M. Orten, A. C. Kuyper, and A. H. Smith (Wayne Univ., Detroit, Mich.). *Food Technology 2,* 308-16(1948). No toxicity was observed following the ingestion of amounts of propyl gallate equivalent to at least 100 times that which would be consumed if all dietary fat were treated with effective amounts of this antioxidant.

THE AUTOXIDATION OF METHYL OLEATE AND LINOLEATE, AND THE DECOMPOSITION OF THE OXIDATION PRODUCTS: A THEORETICAL DISCUSSION. G. P. Gibson (Lever Bros. & Unilever Ltd., Port Sunlight, Cheshire). *J. Chem. Soc. 1948,* 2275-90. By the logical development of a free-radical hypothesis an attempt is made to explain the results obtained when Me esters of the C_{18} acids from palm oil are partly oxidized and then distilled. The activation of the molecules is considered to proceed by bond fission, each broken bond resulting in 2 centers of activity which may rearrange to form free radicals or new bonds. Components that may be activated are an oxygen molecule, and methylene, tertiary carbon, or unsaturated groups. The autoxidation is divided into 2 stages: (I) the induction period, during which the initial formation of a hydroperoxide from Me linoleate takes place, and (II) the autoxidation proper, which is catalyzed by the hydroperoxide. Stage (II) is a chain-reaction cycle operating through the H- and HOO-free radicals. The structure of the hydroperoxides from Me oleate and linoleate is forecast. The hydroperoxides decompose more or less quickly and reaction occurs through either (a) an oxygen atom diradical, -O-, or (b) a hydroxyl radical, -OH. A hydroperoxyl group attacks methylene, tertiary carbon, or unsaturated groups within its own or other molecules, which may, thereby, be split into 2 parts or give mono-, di-, or tri-meric products. The chief decomposition products are considered to be derivatives of α-unsaturated hydroxy-esters, $CH{:}CH{\cdot}CH(OH)$, α,β-dihydroxy-esters, $CH(OH){\cdot}CH(OH)$, and carbonyl compounds, CO. Figures and tables are given illustrating the activation, autoxidation, and decomposition reactions which are likely to occur with Me oleate and linoleate.

THE AUTOXIDATION OF METHYL OLEATE. J. Ross, A. I. Gebheart, and J. F. Gerecht (Colgate-Palmolive-Peet Co.). *J. Am. Chem. Soc. 71,* 282-6(1949). The products of autoxidation of Me oleate at 35° in the presence of ultraviolet light have been examined. The position of substitution of the hydroperoxido groups has been determined by conversion to the corresponding ketostearic acids. Substitution has been shown to occur at C atoms C_8, C_9, C_{10}, and C_{11}. Evidence has been obtained that a double bond shift occurs in the formation of 2 of the above hydroperoxido substitutions so that in all 4 compounds the olefinic group is adjacent to the hydroperoxido group. In the peroxidation and double bond shift only the C atoms C_8, C_9, C_{10}, and C_{11} are involved. The products identified strongly support a chain reaction mechanism sequence involving allylic resonance of the 2 free radicals initially possible.

CHROMATOGRAPHIC ESTIMATION OF VITAMIN A IN WHALE-LIVER OIL. N. T. Gridgeman, G. P. Gibson, and J. P. Savage (Lever Bros. & Unilever Ltd., Port Sunlight, Cheshire). *Analyst 73,* 662-8(1948). Chromatography, on weakly adsorbing alumina, of the unsaponifiable matter of whale-liver oil develops well-defined zones that can be eluted *seriatim* with polar solvents. One zone consists of vitamin A only; it can be collected and assayed spectrophotometrically.

TOCOPHEROL VS. TOCOPHEROL ACETATE AS A "SPARER" OF VITAMIN A. Sister Mary Carolanne Miles, E. M. Erickson, and H. A. Mattill (State Univ. Iowa, Iowa City). *Proc. Soc. Exper. Biol. Med. 70,* 162-5(1949). In bio-assays of vitamin A, α-tocopherol, but not α-tocopherol acetate, increased the rate of gain in the assay period. In a post-assay depletion period animals that received α-tocopherol during the assay period survived 30-80% longer than controls. Some of the possible causes for the failure of α-tocopherol acetate to conserve vitamin A are briefly discussed.

THE INFLUENCE OF TOCOPHEROLS UPON THE MAMMARY AND PLACENTAL TRANSFER OF VITAMIN A IN THE SHEEP, GOAT, AND PIG. F. Whiting (Dominion Exper. Sta., Lethbridge, Alberta, Canada). J. K. Loosli, and J. P. Willman. *J. Animal Sci. 8,* 35-40(1949). Tocopherol supplementation in combination with vitamin A had no significant effect on the vitamin A stores of the new born at birth or on the vitamin A content of colostrum, when compared to those receiving only vitamin A.

POLYETHENOID FATTY ACID METABOLISM. EFFECT OF DIETARY FAT ON POLYETHENOID FATTY ACIDS OF RAT TISSUES. I. G. Rieckehoff (College Agr. & Mech. Arts, Mayaguez, Puerto Rico), R. T. Holman and G. O. Burr. *Arch. Biochem. 20,* 331-40(1949). The tissue fatty acids of the rat retain considerable amounts of the polyunsaturated fatty acids on a fat free diet. The trienoic acid content of heart fatty acids of rats on a fat-deficient diet is relatively high, and this component decreases upon supplementation with corn oil or cod liver oil. When the fat-deficient diet is supplemented with corn oil, a considerable deposition of arachidonic, or tetraenoic acid takes place, indicating that this acid can be synthesized from linoleate. Supplementation of the fat-deficient diet with cod liver oil results in the deposition of considerable quantities of tetraenoic, pentaenoic, and hexaenoic fatty acids in tissue lipids. These acids accumulate, in decreasing order, in the heart, liver, brain, kidney, muscle, skin, and depot fat. The deposition of polyunsaturated fatty acids takes place primarily in the phospholipid fatty acids, very little change taking place in the neutral fat.

Undecylenic acid given orally in psoriasis and neurodermatitis. A preliminary report. H. Harris Perlman (Philadelphia). *J. Am. Med. Assoc. 139,* 444-7(1949). A series of 17 patients with chronic psoriasis, both localized and generalized, were given gradually increased doses of undecylenic acid by mouth for varying periods of time, with definite improvement in the psoriasis characterized by a disappearance of the psoriatic lesions, a permanent relief of the itching complained of and, in several instances associated with arthropathies, a definite disappearance or improvement in the joint pains. This preliminary report is made to spur research, clinical and scientific, on undecylenic and the other unsaturated fatty acids, in all phases.

Tricarbon compounds in the chemical change (metabolism) of fatty acid and fats. K. Taufel. *Angew. Chem. 60A,* 173-5(1948).

Chemistry of the liver cytoplasm of normal, fasted, and cirrhotic mice. N. Kretchmer (Long Island College Med., Brooklyn), and C. P. Barnum. *Proc. Soc. Exper. Biol. Med. 70,* 153-5(1949). Changes in the lipid fraction during a 24-hour fast result in an increase of 3-4 fold above normal. Fasted cirrhotic liver differs from the fasted normal liver cytoplasm in that the lipid does not increase so markedly and the phospholipid decreases to about 60% of the normal fasted value. In the fasted-cirrhotic liver cytoplasm there is also a decrease of "ribonucleic acid" and phospholipid.

Response of guinea pigs to diets deficient in choline. P. Handler (Duke Univ., Durham, N. C.). *Proc. Soc. Exper. Biol. Med. 70,* 70-3(1949). Seven different choline deficient diets were fed to young rats and guinea pigs. While each of these diets resulted in fatty liver formation in the rats in no instance was there observed an appreciable accumulation of fat in the guinea pig livers. This fact has been correlated with the lack of hepatic choline oxidase activity in the guinea pig as compared to all species which have, to date, been found susceptible to dietary choline deficiency.

Lipotropic activity of various compounds under standardized conditions. M. J. Raymond and C. R. Treadwell (George Washington Univ., Washington, D. C.). *Proc. Soc. Exper. Biol. Med. 70,* 43-5(1949). S-ethylcysteine did not decrease the level of the liver lipids, cystine betaine and S-methylcysteine exhibited a slight activity of questionable significance, inositol, dimethyl sulfide, and S-methylisothiourea sulfate were of intermediate activity, and betaine and triethylcholine had approximately the activity of choline. Lipociac, at the 1% dietary level, was highly active lipotropically and stimulated growth to a greater degree than any of the other compounds tested. S-methylisothiourea sulfate depressed the growth rate.

Influence of choline, cystine, and methionine on toxic effects of pyridine and certain related compounds. R. A. Coulson and F. G. Brazda (Louisiana State Univ., New Orleans). *Proc. Soc. Exper. Biol. Med. 69,* 480-7(1948). Livers from apparently healthy animals which have been on a pyridine diet show a nearly normal water content and are enlarged. Cystine and methionine afford protection against the effects of pyridine. The feeding of quinoline alone or quinoline supplemented with either choline, cystine, or methionine produced enlarged livers. Cystine and methionine increased survival time. Choline showed some protective effect. Cystine or methionine prevented the accumulation of water in the livers of rats fed quinoline. Choline had no effect.

The effect of fatty acids on the oxygen uptake of *Blastomyces dermatitidis.* S. Levine and M. Novak (Univ. Illinois, Chicago). *J. Bact. 57,* 93-4 (1949). All of the acids from acetic through caprylic stimulated oxygen uptake. The acids with longer C chains than caprylic acid inhibit oxygen uptake. Increasing the number of double bonds in the molecule, as in the case of oleic and linoleic acids, has no effect on the inhibition of oxygen uptake.

On the mechanism of enzyme action. XXXIV. The influence of a pigment from *Fusarium solani* D_2 purple (solanione) on the composition of fats formed in *Fusaria.* I. Deschamps (Fordham Univ., New York). *Arch. Biochem. 20,* 457-464(1949). Solanione, a pigment present in *Fusarium solani* D_2 purple, has no appreciable effect upon the growth of, and the type of fat produced by, the mold *Fusarium lycopersici,* which can be grown as a pigment producer. Solanione, as shown previously, has a marked effect on the growth of the non-pigmented *Fusarium lini* B. The pigment under consideration is the cause of the change in the fat metabolism of the mold, namely, the desaturation of the fatty acid constituents, as shown by the difference in iodine absorption. The addition of solanione increased the desaturation of fats produced by *Fusarium lini* Bolley and seems to affect the hydrogen transport system present in this mold.

Amino acid and unsaturated fatty acid requirements of *Clostridium sporogenes.* G. M. Shull (Chas. Pfizer and Co., Inc., Brooklyn, N. Y.), R. W. Thoma and W. H. Peterson. *Arch. Biochem. 20,* 227-41(1949). High concentrations of certain combinations of amino acids can replace partial protein digests in media for *Clostridium sporogenes.* Oleic, vaccenic, linoleic, and ricinoleic acids are active, in the order named, in replacing biotin, both in the basal medium and in arginine-tyrosine medium. The use of emulsifying agents such as the Tweens greatly facilitates the demonstration of this phenomenon. Tween 80, an oleic acid ester, is active in high concentrations in replacing biotin.

PATENTS

Refining and bleaching fatty oils. D. S. Bolley and E. C. Gallagher (Nat'l Lead Co.). *U. S. 2,458, 554.* The fats and oils are mixed with a small amount of H_2SO_4 and the mixture is bleached with earths.

Continuous fat splitting. M. H. Ittner (Colgate-Palmolive-Peet Co.). *U. S. 2,458,170.* In the process of hydrolyzing fats with water to fatty acids and glycerine is a method of finely dividing the water to facilitate the washing, which comprises mixing the water with a portion of the fatty acids and forcing the mixture of fatty acids and water under pressure, into the fatty matter, with sufficient velocity to effect a fine state of division of the water.

FATTY ACID SEPARATION. C. C. Towne (The Texas Co.). *U. S. 2,459,054.* The design of equipment and process is described for separating oleic and linoleic by liquid-liquid extraction with a low boiling ketone.

ANTIOXIDANT FOR FATS. M. M. Piskur and J. W. Higgins (Swift & Co.). *U. S. 2,461,080.* Citrus material is added to fatty tissue during rendering or to animal fats during deodorization in order that the finished fat will be more stable.

NORDIHYDROGUAIARETIC ACID. G. P. Mueller, E. T. Stiller, and S. V. Lieberman (Wyeth Inc.). *U. S. 2,456,443.* This invention involves the synthesis of 2,3-bis (3,4-carbonyldioxybenzyl)-butane and nordihydroguaiaretic acid in substantially pure crystalline form from easily procurable and relatively inexpensive starting material.

ELASTOMER. A. W. Ralston and H. M. Corley (Armour and Co.). *U. S. 2,461,349.* The process for preparing a synthetic elastomer compound comprises mixing a tallölnitrile with butadiene, and thereafter polymerizing the mixture to form a synthetic elastomer compound.

SOLUBLE OIL FOR THE LEATHER INDUSTRY. R. M. Koppenhoefer (Socony-Vacuum Oil Co., Inc.). *U. S. 2,456,587.* The fat liquoring composition contains mineral oil, 6-12 rosin acids, 6-12 polyoxyethylene hexitol fatty acid derivative, 3-6 lower fatty acid and 10-16% of a substituted glyoxalidine.

WATER-REPELLENT FOR TEXTILES. C. T. Rood (S. C. Johnson & Son, Inc.). *U. S. 2,456,595.* The solid water-repellent composition of matter contains not more than 15% of water and is readily dispersable in hot water. It consists essentially of paraffin wax, aluminum formate, and a mixed dispersing agent comprising sorbitan monopalmitate and polyoxyalkylene sorbitan monopalmitate in a ratio within the range of from 4:6-6:4 by weight.

CONTINUOUS METHOD FOR DETERMINING THE APPARENT VISCOSITY OF A GREASE. J. C. Zimmer and A. Beerbower (Standard Oil Development Co.). *U. S. 2,459,483.*

CORROSION RETARDER. J. T. Rucker (Hooker Electrochemical Co.). *U. S. 2,459,119.* The method of protecting bearing metals in automobile crankcases against organic acids developed in lubricating oils during use comprises incorporating in the oil 0.005-0.1% of a substantially eutectic mixture of lauryl pyridinium chloride and benzyl thiocyanate.

LUBRICATING OIL. A. G. Rocchini (Gulf Res. & Development Co.). *U. S. 2,458,425.* The oil consists of a major proportion of a mineral oil and a minor proportion sufficient to improve the detergent, antioxidant, and anti-corrosion characteristics of the mineral oil of an oil-soluble polyvalent metal salt of an alkenyl-succinic acid monoamide in which the alkenyl group contains from 5-18 C atoms.

Drying Oils

Edited by
ROBERT E. BEAL

PROGRESS IN THE PROTECTIVE COATINGS AND PLASTICS INDUSTRIES. CONTRIBUTIONS OF THE OIL CHEMIST. D. H. Wheeler (General Mills, Inc., Minneapolis, Minn.). *Ind. Eng. Chem. 41,* 252-8(1949). Recent advances in drying oil technology may be ascribed largely to the application of the reactive functionality concept of polymer reaction and formation. This concept may be applied with considerable confidence to thermal polymerization reactions. Although oxidation reactions are not well understood an approximate oxidative functionality may be applied to the fatty acids. Theories for oxidation polymerization are critically examined. 52 references.

FORMATION OF CONJUGATED DIENE SYSTEMS FOR VARNISHES AND PAINT VEHICLES. H. P. Kaufmann and G. Gaueff. *Paint, Oil, Chem. Rev. 112,* No. 4, 12, 14, 48, 50, 52-3(1949). Translated from *Fette u. Seifen 50,* 425-31(1943). Methods of producing conjugated drying oils by synthesis and by dehydration are reviewed. The synthesis of saturated fatty acids and their subsequent dehydrogenation gives low, uneconomical yields. Dehydration of dihydroxystearic acid gave a viscous mass comprising unreacted material and estolides, but the ethyl ester of this acid dehydrated largely to the keto stearate. Ricinoleic acid may be readily dehydrated to conjugated linoleic acid; however, it is more economical to dehydrate the castor oil from which the acid is obtained when a drying oil is desired. Heating the oil under vacuum with 2% WO_3 at 180°-280° gave a drying oil with the following characteristics: acid value 5.2, ester value 178.5, saponification value 183.2, I value 186 (determined by Br in CCl_4), thiocyanate value 85.5, diene value 18.3. Dehydration catalysts and processes are reviewed. Samples of poppyseed, corn, and soybean oil oxidized for three hours at 120°-130° and dehydrated with 0.1% ethylhydrogensulfate under vacuum gave films which dried in 20 hours, were equal in gloss to linseed oil films but somewhat softer, possessed good water and heat resistance, and made satisfactory paints.

POLYMERIZATION OF SOME JAPANESE VEGETABLE OILS. H. Nabori and Kyuji Nakajima. *J. Soc. Chem. Ind. Japan 49,* 13-14(1946). Linseed oil gelatinized in 13 hours at 300° with CO_2 agitation while soybean gelatinized after 17 hours during which time the I value decreased rapidly at first and then linearly with time. Cottonseed and rice oil resembled soybean oil in bodying characteristics while rapeseed and peanut oils were difficult to polymerize. (*Chem. Abs. 42,* 6139.)

DRYING PROPERTIES OF SUNFLOWER-SEED OIL. S. Castorina (Stazione sperimentale olivicultura e oleificio, Pescara, Italy). *Olearia 1948,* 391-6. A film of sunflower-seed oil increased in weight as follows: 1 day 1.53%, 2 days 2.78%, 3 days 3.57%, 4 days 4.22%, 5 days 4.35%, 10 days 4.51%. A coating of trichloroethylene-extracted sunflower-seed oil dried in 15 days while a pressed oil required 30 days. Equal parts of boiled linseed and boiled sunflower-seed oils dry in about the same time as linseed oil and the film is softer, glossier, and more elastic than a linseed oil film. (*Chem. Abs. 42,* 8492.)

TUNG OIL. ITS PAST, PRESENT, AND FUTURE. J. M. Hofeli. *By Gum! 19,* No. 5, 7, 10-13(1948); *Can. Paint & Varnish Mag. 22,* No. 11, 36, 38, 40, 42, 62-3 (1948). (*Chem. Abs.*)

DETERMINATION OF THE ACID NUMBER OF STAND OILS. Commissie Chem. Analysemethoden. *Veofkroniek 21,* 208-9(1948). A method more accurate than those commonly used requires a 10-g. sample dissolved in 60 cc. of a 3:1 toluene—96% ethanol mixture neutralized with 0.1 N alcoholic KOH. The solution is titrated to a phenophthalein endpoint with 0.1 N alcoholic KOH and toluene is added if the solution becomes turbid. (*Chem. Abs. 43,* 419.)

PATENTS

Tall oil—cellulose ether composition. W. Stubblebine (Armstrong Cork Co., Lancaster, Pa.). *U. S. 2,457,847.* A compatible mixture obtained by heating a major proportion of tall oil and a minor proportion of an alkali-insoluble cellulose ether selected from the group consisting of ethyl cellulose and benzyl cellulose is mixed with a coumarone indene resin to produce a useful composition.

Extraction of useful products from heavy petroleum residue. Trinidad Leaseholds Ltd. and E. Hene. *Brit. 574,460.* Materials extracted from petroleum residues with petroleum ether are fractionated with aqueous butanol to obtain a resin useful for coating purposes and a resin suitable as a substitute for linseed oil. (*Chem. Abs. 42,* 7522.)

Soap

Edited by
LENORE PETCHAFT

Detergents from petroleum. B. H. Weil (Georgia School of Technology, Atlanta, Georgia). *Petroleum Refiner 27,* No. 5, 261-8(1948). A general review of the detergent field with special emphasis on detergents which can be produced from petroleum. Types and trade names manufactured by various companies are outlined. The many uses and competition with soap are factors discussed in detail. Economics of production and sales are included. 48 references.

New method for the rapid titrimetric analysis of sodium alkyl sulfates and related compounds. S. R. Epton. *Trans. Faraday Soc. 44,* 226-30(1948). If a dilute solution of the anion-active material containing a little acid methylene blue is shaken with $CHCl_3$, the blue color is concentrated in the $CHCl_3$ layer. If then a solution of cetyl pyridinium bromide is added slowly, the distribution of the color is not at first altered, but as the quantity nears equivalence a fairly rapid transfer of color occurs from the lower to the upper layer. Eventually the two layers assume the same color at the equivalence point. On further addition of the reagent the lower layer lightens in shade and finally becomes colorless. Results are reproducible to ± 0.5 to ± 1.0%. The concentration of alkyl sulfate solutions is determined with good accuracy when the chain length is from 8 C atoms upwards. Water-insoluble sulfonates of very high molecular weight can also be analyzed. The method is applicable to mixtures of Na secondary alkyl sulfate made by sulfation of olefin mixtures of varying mean chain lengths. (*Chem. Abs. 43,* 522.)

The nature of wetting and dispersion. II. Lomas. *J. Oil & Colour Chemists' Assoc. 31,* 265-9 (1948). Definitions of wetting agent and dispersing agent are given and each is treated as a separate problem. A discussion of the action of wetting agents with various system conditions is attempted. Diagrams are used to illustrate the various solid/liquid/vapor interfaces that may be encountered. Dispersion is also discussed briefly, and comments are made on the action of dispersion on settling of pigments. The value of the study of the forces activating pigments is outlined. (*Chem. Abs. 43,* 1196.)

Elements of detergency. Georgia Leffingwell. *Rayon Synthetic Textiles. 30,* No. 3, 83-5(1949). General review article covering explanation of emulsification by soap, colloidal action of soap, importance of lowering surface tension prior to cleansing and relation of these aspects to textile processing both with soap and synthetic detergents.

Evaluation of ternary mixtures. Synthetic detergent-soap-builder. J. J. Merrisroe and R. G. Newhall (Oronite Chemical Co., San Francisco, Calif.). *Ind. Eng. Chem. 41,* 423-9(1949). The pH, foaming, and detergency of a variety of binary mixtures have been studied. These mixtures include both soap-builder combinations and synthetic detergent-builder combinations. The ternary system sodium stearate-synthetic detergent-tetrasodium pyrophosphate has also been investigated. It has been found that such mixtures when used in hard water may be so proportioned as to exhibit either high detergency and high foaming or high detergency and low foaming.

Suspension of manganese dioxide in detergent solutions. Leonard Greiner and Robert D. Vold (University of Southern Calif., Los Angeles, Calif.). *J. Phys. & Colloid Chem. 53,* 67-88(1949). Data were obtained on the quantity of powdered manganese dioxide remaining in suspension after 4 hours in solutions of anionic, cationic, and non-electrolytic synthetic detergents, sodium oleate, *p*-toluenesulfonic acid. The non-ionic detergent showed no suspending power; all the other substances showed a sharp maximum in the suspending power-concentration curve at a low concentration. Suspending power apparently is not related to solubilization of colloidality of the solution except to the extent that formation of colloid effects the concentration of simple ions. Experiments with an improved sedimentation balance appear to show that the dispersing agents aid suspendibility by deflocculating the powder particles, which are associated by water into secondary aggregates of larger size than the primary particles in the dry powder. 38 references.

Studies on aluminum soaps. I. Viscosity and streaming birefringence of aluminum soap solutions. V. R. Gray and A. E. Alexander (Cambridge University, Cambridge, England). *J. Phys. & Colloid Chem. 53,* 9-23(1949.) Viscosity measurements on dilute solutions of aluminum soaps in benzene lead to the conclusion that at infinite dilution the units approach single molecules, with a strong intermolecular force which causes a rapid increase of viscosity with concentration. Streaming birefringence and viscosity measurements on more concentrated solutions were made in a coaxial cylinder apparatus. It is concluded that the soap molecules aggregate to form long fibrous micelles with fatty acid chains extended sideways. Most solutions were initially birefringent, and so possessed liquid crystalline structure. 34 references.