ABSTRACTS

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• Fats and Oils

STUDIES ON THE MECHANISM OF THE BREAD-IMPROVING EFFECT OF LIPIDS. Y. Pomeranz, G. L. Rubenthaler and K. F. Finney (Crops Res. Div., Agr. Res. Ser., USDA, Manhattan, Kansas, 66502). *Food Technol.* 20(11), 1485–88 (1966). Adding mineral oil or petroleum jelly to wheat flour improved loaf volume and crumb grain somewhat. Mineral waxes had no effect on gassing power, proof height, water absorption at the mixing stage or amylograph characteristics. High-melting-point waxes (96–99C) increased loaf volume little, while waxes with a melting point between 61 and 85C substantially improved loaf volume, crumb grain, and freshness retention. Although the non-nutritive character of the mineral components makes the results of theoretical interest only, the possibility of increasing loaf volume by high-melting unreactive compounds at elevated temperatures has been shown.

CHEMICAL EXAMINATION OF THE SEEDS OF GREWIA POPULIFOLIA VAHL. S. N. Ganguly, A. K. Bhattacharya and G. Ganguli (Dept. of Chem., Univ. College of Sci. and Technol., Calcutta). *J. Ind. Chem. Soc.* 6, 453–55 (1966). The seeds of *Grewia populifolia* Vahl were extracted and fractionated. β-Sitosterol and stigmasterol were detected.

THE DIFFERENTIAL THERMAL ANALYSIS OF EDIBLE FATS. D. P. J. Moran (Unilever Res., Lab., The Frythe, Welwyn, Herts). *Proc. Soc. Anal. Chem.* 3, 170–71 (1966). The importance of thermal pre-treatment was emphasized for obtaining reproducible results. The area of the differential thermal analysis curve showed a linear relationship with the dilatation of fats, and may be used to corroborate such evidence. Further applications for differential thermal analysis are hydrogenation, fractionation processes and emulsifiers.

ANTIOXIDANTS FOR THE (THIN-LAYER) CHROMATOGRAPHY OF LIPIDS. T. S. Neudoerffer and C. H. Lea (Low Temp. Res. Sta., Cambridge, Great Britain). *J. Chromatog.* 21, 130–40 (1966). Thin-layer chromatography with highly oxidizable material such as phosphatidylethanolamine was shown to be greatly improved when the plates were run in the dark in air at 0C, and the presence of an antioxidant. BHQ was found to be about twice as powerful on an equal basis as BHT.

TRANSESTERIFICATION OF LECITHIN ON SILICIC ACID COLUMNS. G. Camejo (Dept. Biochem., Albert Einstein College of Med., Yeshwa Univ., New York, N. Y.). *J. Chromatog.* 21, 6–12 (1966). Natural and synthetic lecithins undergo transesterification and hydrolysis during chromatography on silicic acid columns. Since these reactions are of importance in relation to the detection of lysolecithin in animal tissues, some of the factors influencing the reactions were studied.

DETECTION OF REARRANGEMENT REACTION OF NATURAL GLYCERIDES BY CHROMATOGRAPHY. M. M. Chakrabarty, D. Bhattacharyya and A. Gupta (Dept. Appl. Chem., Calcutta Univ., Calcutta, India). *J. Chromatog.* 22, 84–89 (1966). The techniques of reverse phase paper and thin-layer chromatography have been applied for the rapid detection of the rearrangement reaction involving randomization of some oils containing high percentages of unsaturated acids. It is shown that these two techniques separate the component glycerides readily permitting visualization and detection of the effect of such rearrangements on glyceride composition.

THE RELATION OF STRUCTURE TO ANTIOXIDANT ACTIVITY OF QUERCETIN AND SOME OF ITS DERIVATIVES. II. SECONDARY (METAL-COMPLEXING) ACTIVITY. A. Letan (Low Temp. Res. Station, Cambridge, U.K.). *J. Food Sci.* 31(3), 395–99 (1966). The secondary (metal complexing) activity of quercetin and some of its derivatives was studied with the conventional Warburg technique in an ascorbic acid system catalyzed with cupric ions. The 3-hydroxy-4-keto group was the most powerful metal-complexing group in the quercetin molecule; the 5-hydroxy-4-keto group had some activity, but was considerably weaker. The 3′, 4′-*o*-diphenolic group, important for the primary antioxidant activity, possessed virtually no metal-deactivating properties.

A RAPID APPROXIMATE ANALYTICAL METHOD FOR SIMULTANEOUS DETERMINATION OF MOISTURE AND FAT IN MEAT AND MEAT PRODUCTS. C. E. Davis, H. W. Ockerman and V. R. Cahill (Ohio State Univ., Columbus, Ohio). *Food Technol.* 20(11), 1475–77 (1966). The reported method was compared with an air oven moisture determination followed by a Soxhlet fat extraction. Correlation coefficients between the two methods were highly significant. Reliable results for a sample are easily obtained within 2.5 hours rather than 24 hours for the usual methods.

QUANTITATIVE DETERMINATION OF CHOLESTEROL IN AUTOXIDATION MIXTURES BY THIN-LAYER CHROMATOGRAPHY. C. Horvath (Phy. Res. Lab., Mass. Gen. Hospital, Boston, Mass.). *J. Chromatog.* 22, 52–9 (1966). A method is presented for the quantitative determination of cholesterol in the presence of its oxidation and degradation products arising from thermal and radiation induced decomposition. The samples are chromatographed on silica gel coated thin-layer plates with a chloroform-acetone mixture. By removing the separated cholesterol, developing the color, and measuring the absorbance, 20–200 μg cholesterol can be determined with less than 2% error.

QUANTITATIVE SEPARATION OF STEROIDS IN OILY SOLUTIONS BY MEANS OF THIN-LAYER CHROMATOGRAPHY WITH CONTINUOUS ELUTION. G. Cavina and G. Moretti (Instituto Superiore di Sanita, Rome, Italy). *J. Chromatog.* 22, 41–51 (1966). A description of a thin-layer chromatographic method for the determination of less polar hormonal steriods in an oily solution is given. By using an ascending technique with continuous elution, steroids are separated from tri- and di-glycerides and free fatty acids.

REACTIVITIES OF LIPID SOLVENTS WITH THIOBARBITURIC ACID. S. Y. Ho and W. D. Brown (Inst. of Marine Res., Dept. Nutr. Sci., Univ. of Calif., Berkeley, Calif. 94720). *J. Food Sci.* 31(3), 386–89 (1966). Pigments with absorption maxima at 450 and 532 mμ were readily formed under test conditions from petroleum ether and diethyl ether. Methyl alcohol, ethyl alcohol, chloroform, and hexane reacted to a lesser extent. Carbon tetrachloride was unreactive. The production of these malonaldehyde-like compounds, presumably from contaminants in the solvents, was increased by heating.

DEFATTING AND DEODORIZATION OF FISH PROTEIN CONCENTRATE FROM HARPODEN NEHEREUS. D. P. Sen, T. S. Satyanarayana Rao and N. L. Lahiry (Ctr. Food Technol. Res. Inst., Mysore 2, India). *J. Food Sci.* 31(3), 344–50 (1966). Petroleum ether extractives ("true" lipids), residual fats ("bound" lipids) obtained by acid hydrolysis, and ethanol extractives other than "true" and "bound" lipids were obtained from Bombay-duck fish. All lipid fractions contributed to its odor, the last two fractions being more important.

RECENT DEVELOPMENTS IN THE CHEMISTRY OF FATTY ACIDS. M. F. Ansell (Queen Mary College, Univ. of London, Mile End Rd., London, England). *J. Oil Col. Chem. Assoc.* 49, 884–93 (1966). Recent developments in the elucidation of the mechanisms of the reactions of fatty acids in strong acid media, fused alkali media, and under autoxidation conditions are described.

THE PRACTICE OF DEEP FAT FRYING. C. J. Robertson (Procter and Gamble Co., Cincinnati, Ohio). *Food Technol.* 21, 34–6 (1967). This paper was the first of a series of the symposium on Chemistry and Technology of Deep Fat Frying held by The Institute of Food Technol. This paper is very general and covers such topics as turnover period, heat distribution, various frying processes, and kettle design, composition and cleanability.

SOLUBILITY OF GASES IN FATTY OILS. Noboru Tomoto and Kazuhito Kusano (Miyazaki Univ.). *Yukagaku* 16, 108–13 (1967). The solubility of gases in fatty oils followed Henry's law under constant temperature. In general, the solubility decreased with an increase of temperature with some exception when solvent is used as in case of soybean oil and oxygen. Bunsen's absorption coefficient of gases on soybean oil, olive oil and linseed oil are tabulated. The differential heat of solution of carbon dioxide in fatty oils does not show much variation but the value depends on molar volume or on the iodine number of fatty oil. In spite of low solubility of hydrogen in fatty oils, differential heat of solution is larger than the other gases. The viscosities of soybean oil in vacuo or that saturated with carbon dioxide at definite pressure are measured. The viscosity of oil is decreased linearly with an increase of dissolved gas.

ANTIOXIDANT ACTIVITY OF GLYCERYLPHOSPHATIDES AND THEIR HYDROLYSIS PRODUCTS. V. MECHANISM FOR ANTIOXIDANT ACTIVITY OF ALKYL PHOSPHATES AND β-GLYCERYLPHOSPHORIC ACID. Chieko Urakami, Ayako Kameyama, Naoko Morikawa and Eiko Kajimoto (Osaka Munic. Univ.). *Yukagaku* 16, 123–6 (1967). Trimethyl, triethyl and tributyl phosphate and

β-glycerylphosphoric acid were found to be active antioxidants for unsaturated fatty acid esters at a concentration 0.01–0.04%. Estimation of ultraviolet and infrared absorption peaks of methyl linoleate containing tributyl phosphate and β-glycerylphosphoric acid in hexane indicated an interaction of the PO group of the phosphate esters possibly with the α-methylene group of the methyl linoleate molecule resulting in perturbation of the π electrons of the double bonds of the latter. Therefore, a possible mechanism for the observed antioxidant activity of these esters involves either such an interaction or the formation of an unstable oil-soluble product as a result of such an interaction in early stages of autoxidation, rather than decomposition of hydroperoxides as has generally been regarded for phosphate esters.

BÖMER NUMBER. IV. FATTY ACID COMPOSITION OF CRYSTALLIZED GLYCERIDES. Masao Imamura, Isao Niiya, Kazuko Takagi, and Taro Matsumoto. *Yukagaku* **16**, 61–4 (1967). Average fatty acid content of crystallized glyceride from abdominal fat was 41.2% C-16 acid and 56.1% C-18 acids, while that from back was 40.5% and 56.8%, respectively. Calculated from the C-16 acid, the average content of stearo-dipalmitin was 23.6% from the abdomen and 21.5% from the back. The average content of oleic acid was 2.3% and this gave 7.5% of monounsaturated glyceride. When the crystallized glyceride contained large amount of stearodipalmitin and monounsaturated glyceride, $S_g - S_f$ (S_g = m.p. of glyceride and S_f = m.p. of fatty acid) value became higher and gave higher Bömer number. Lower amount of those was accompanied with high S_g value and high Bömer number. Large amounts of stearo dipalmitin or a smaller amount of monounsaturated glyceride, or vice versa, caused the decrease in Bömer number. Repeated recrystallation of glyceride from ether or acetone gave decreased content of stearodipalmitin and monounsaturated glyceride.

V. DETECTION OF FOREIGN FATTY ACID COMPONENT AND COMPOSITION. Ibid., 119–22. Pentadecanoic acid was found in beef tallow and horse fat but it was not found in lard. Therefore, detection of 0.1–0.2% of pentadecanoic acid in lard is considered to contain 5–10% of horse fat or tallow and the accuracy is better than the determination of Bömer number.

ANTARCTIC WHALE OILS BY GAS-LIQUID CHROMATOGRAPHY USING A HYDROGEN FLAME IONIZATION DETECTOR. VII. IDENTIFICATION OF 4,8,12-TRIMETHYLTRIDECANOIC ACID AS A CONSTITUENT OF WHALE OIL. Yoshihiko Sano (Miyoshi Oil & Fat Co., Tokyo). *Yukagaku* **16**, 56–61 (1967). A minor component in the multibranched-chain fatty acids, separated earlier from whale oil, was identified by gas-liquid chromatography as 4,8,12-trimethyltridecanoic acid, which was synthesized for comparison from both farnesol and phytol and confirmed by means of infrared absorption, nuclear magnetic resonance, and mass spectrometry. The acid content in the fin whale blubber oil was about 0.005% of total weight of fatty acids and this was found in sperm whale blubber, blue whale bones and sea whale blubber.

RANCID FLAVOR OF EDIBLE OILS. II. RELATIONSHIP BETWEEN RACIDITY AND FATTY ACID COMPOSITION. Naoki Iwata, Masaharu Morita and Shizuyuki Ota (Ajinomoto Co., Kawasaki, Kanagawa Pref.). *Yukagaku* **16**, 113–19 (1967). The flavors of rancid soybean, corn and olive oils were evaluated by the functional test and natures of their flavors were described. Although the difference in the quality of rancid flavor in these oils was small, the flavor of each oil was rather characteristic with predominated "green" and "fishy" flavor in rancid soybean oil, "hay-like" flavor in rancid corn oil and "heavy" flavor in rancid olive oil. Chromatographic analyses on the volatile components of the rancid oils showed that these fractions were mainly composed of degradation products of linolenic acid. A considerable amount of decomposition products of linolenic acid were seen in the volatiles of rancid soybean oil, while the decomposition product of oleic acid was small and there was little or no detection in the volatiles of rancid olive oil. Slight difference in rancid flavor of these oils appears to be depended on the difference in quantity of volatile compounds and also on the difference in fatty acid composition of original oils. The intensity of rancid flavor in these oils seems to be correlated with their peroxide value and is independent of their fatty acid composition.

EFFECT OF HEAT ON FATTY ACIDS. STUDIES OF FIVE BAKED PRODUCTS, USING THREE FATS. J. A. Phillips and G. E. Vail (Purdue Univ., Lafayette, Ind.). *J. Am. Dietetic Assoc.* **50**, 116–21 (1967). Five bakery products were prepared, using corn oil, a hydrogenated vegetable shortening and a corn oil margarine. Crude lipid was extracted from these products, before and after baking, and analyzed for degree of unsaturation and fatty acid composition. The ratio of linoleic acid to all saturated acids was found to decrease slightly during baking in pastry and biscuits made with corn oil, in all products made with shortening and in plain cake made with margarine. The ratio of linoleic acid to all other acids did not show these changes except for pastry made with corn oil. I.V. values showed a small decrease during baking in pastry, sugar cookies and plain cake made with corn oil and in pastry made with shortening, no change in all other products. Overall, there were no important changes in the degree of unsaturation during baking for these products made with the three fats studied. Only the percentage of linoleic acid in biscuits made with shortening showed a change of more than 1% during baking.

REFINING OF VEGETABLE OILS IN THE PRESENCE OF HYDROTROPIC SUBSTANCES. A. Koebner, E. Fedeli and G. Jacini (Fats and Oils Exper. Station, Milan, Italy). *Riv. Ital. Sostanze Grasse* **43**, 522–7 (1966). When vegetable oils containing a high level of free fatty acids are refined in the presence of a hydrotrope, the resultant soaps can be solubilized by it and the economics of refining such an oil are greatly improved. Pilot plant experiments using sodium xylene sulfonate as the hydrotrope have given refining losses from 25% for high FFA oils (35–40%) to 6% for lower FFA oils (4–6%). The optimum amount of this hydrotrope is between 2 and 2.5 times, by weight, the amount of FFA in the oil to be refined. Procedures for the recovery and recycle of the hydrotrope solution have been studied and the average loss of hydrotrope measured at about 2% per cycle.

OPTICAL ROTATORY DISPERSION AND ABSOLUTE CONFIGURATION OF SOME LONG-CHAIN HYDROXY ACIDS. T. H. Applewhite, R. G. Binder and W. Gaffield (Western Regional Res. Lab., Agr. Res. Serv., U.S.D.A., Albany, Calif. 94710). *J. Organic Chem.* 32, 1173–8 (1967). Several long-chain, unsaturated, hydroxy acids from plant sources and selected derivatives have been examined spectropolarimetrically. These measurements coupled with earlier unequivocal synthesis allow configurational assignments to be made for the saturated and, hence, the parent unsaturated hydroxy acids. Evidence is presented that the low-intensity ester transition has no effect on the observed optical rotatory dispersion of the hydroxy acid esters.

EFFECTS OF AGITATION AND TEMPERATURE IN DEEP-FAT FRYING OF POTATOES. II. DETERMINATION OF EFFICIENCY OF THE DEEP-FAT FRYER. H. Strock, C. O. Ball and S. S. Chang (Dept. of Food Science, Rutgers, The State Univ., New Brunswick, N.J.). *Food Technol.* 21(4), 163–66 (1967). The effects of temperature and agitation on the efficiency of fryers in deep-fat frying of potatoes were determined. These relationships were compared for temperatures of 340, 365 and 390F using: 1) circulation of fat at 1.0 and 2.0 gpm; and 2) agitation of fat with steam that entered at rates of 0.8 and 1.2 pph. The efficiency of the fryer was measured by two methods: 1) an empirical formula for determination of the difference between usable and total heat; and 2) a comparative indication of the amount of total heat available (Btu) in the fryer upon insertion of sample loads of potatoes, as measured by initial temperature drop at each of eight prepositioned thermocouple points within each fryer. Results from both methods indicate that, throughout the frying medium at a thermostatically controlled temperature, agitation by releasing steam into the hot fat resulted in a more uniform distribution of heat than did nonagitation. This method of distribution, however, was not as efficient as agitation by circulation.

PROCESS OF SIZING SHAPED FIBROUS ARTICLES WITH POWDERED FATTY ACIDS OF 18 TO 24 C ATOMS. G. D. Sinclair and H. R. Sallans (Nat. Res. Council of Canada). *U.S. 3,306,812.* A process for sizing relatively rigid shaped fibrous articles such as hardboards consists in mixing into a slurry of fibrous pulp stock having a pH of 4 to 10, about 0.5–2% by wt. of a sizing agent consisting of a dry, powdered, long chain fatty acid with 18 to 24 straight chain carbon atoms in its molecule, forming the pulp into a shaped article and hot pressing the article at temperature sufficient to cause the fatty acid to vaporize.

RENDERING APPARATUS. J. Corrigan (J. C. Corrigan Co.). *U.S. 3,307,916.* An apparatus for rendering tallow comprises means for separating and recirculating unmelted solid material.