# ABSTRACTS

R. A. REINERS, Editor. ABSTRACTORS: R. Aguilar B., J. G. Endres, Kazuo Fukuzumi, J. Iavicoli, K. Kitsuta, F. A. Kummerow, Gladys Macy, Louise R. Morrow, E. G. Perkins, T. H. Smouse and J. A. Thompson

## • Fats and Oils

The occurrence of a natural antioxidant in citrus fruit. S. V. Ting and W. F. Newhall (Florida Citrus Exp. Sta., Lake Alfred, Florida). *J. Food Sci.* 30, 57–64 (1965). Antioxidant activity was found chiefly in the flavedo of citrus fruits. Orange was found to have the highest activity with lime and lemon having almost no antioxidant activity. The amount of activity of the various fractions studied was measured by a macro-manometric apparatus which measured the amount of oxygen adsorbed by *d*-limonene. Alumina column chromatography was found to yield an oily fraction rich in activity. Thin-layer chromatograhy, a positive ferric chloride-dipyridyl test and the non-polarity of the unknown active material indicate possibly a tocopherol.

Collaborative study on the quantitative determination of volatile fatty acids by gas chromatography and by column partition chromatography. H. Salwin (Div. of Food Chem., F.D.A., Washington, D.C. 20204). *J. Assoc. Offic. Agr. Chem.* 48, 628–35 (1965). The results obtained by the gas chromatographic method were as accurate as, and possibly more accurate than, those obtained by the A.O.A.C. method. The precision of the two methods was approximately equal. The gas chromatographic method has the advantages of a single procedure for formic, acetic, propionic, and butyric, improved specificity and sensitivity, a permanent record of the analysis and a more rapid procedure for some analyses.

Separation and identification of sodium salts of acetic, propionic, butyric, and valeric acids by paper chromatography. J. A. Young, G Schwartzman and Anna L. Melton (F.D.A., 1141 Central Parkway, Cincinnati, Ohio 45202). *J. Assoc. Offic. Agr. Chem.* 48, 622–24 (1965). A method is presented to confirm the identity of volatile acids after steam distillation separation by silicic acid chromatography and sodium hydroxide titration. The method works equally well for the detection of propionates in bread products. The developer is a mixture of two volumes of acetone added to equal volumes of n-butanol, t-butanol, and concentrated ammonia. This system was found to give more distinct separation of the acid spots and development time was reduced.

Isolation and identification of the volatile fatty acids present in hickory sawdust smoke. H. A. Hamid and R. C. Saffle (Food Technol. Dept., Univ. of Georgia, Athens, Georgia 30601). *J. Food Sci.* 30, 697–702 (1965). Acetic, propionic, butyric, iso-valeric, n-valeric, iso-caproic, and n-caproic acids were identified in hickory sawdust smoke by gas chromatography, and the relative amounts of each were determined. Formic acid was not detected since a hydrogen flame ionization detector was used and is insensitive to this acid. A total of eight columns were evaluated, three of which were used for identification by retention times as well as infrared spectrophotometry.

Some effects of high levels of gamma irradiation on the lipids of wheat. K. H. Tipples and F. W. Norris (Grain Res. Lab., Winnipeg, Manitoba). *Cereal Chem.* 42, 437–51 (1965). Gamma irradiation produced small changes in the lipid fractions of irradiated wheat. Linoleic and linolenic acids decreased slightly and the unesterified fatty acids appeared to be more susceptible to irradiation damage than esterified acids. Carotenoids and the tocopherols decreased with increasing radiation. Upon storage, linoleic and linolenic acids were autoxidized more slowly in the radiated samples than in the control. Irradiation tended to cause a decrease in triglycerides, galactolipids and phospholipids and an increase in the free sterols, monoglycerides and diglycerides.

The effect of storage time on the compositional patterns of rice fatty acids. Ten-Ching Lee, Wei T. Wu and Virginia R. Williams (Dept. of Biochem., La. State Univ., Baton Rouge, La.). *Cereal Chem.* 42, 498–505 (1965). Significant variation occurred from one sampling period to the next, but significant correlation between percentage composition and time was found in only two cases: the oleic acid and the linoleic acid of the phospholipid fraction. The oleic acid increased and the linoleic acid decreased with storage time. The same trend occurred in the free fatty acids and mono- and diglycerides.

Changes in lipid composition in maturing wheat. R. D. Daftary and Y. Pomranz (Dept. of Flour and Feed Milling Ind., Kansas State Univ., Manhattan, Kansas 66504). *J. Food Sci.* 30, 577–81 (1965). Changes in lipid composition during wheat development were followed by qualitative and quantitative thin-layer chromatography (TLC) and by fractionation on silicic acid columns. Development of the wheats was accompanied by a slight decrease of lipid content on an as-is basis, and by an almost doubling of lipids on a kernel basis. Free fatty acids in mature wheat were less than half the amount in wheat 21–23 days preceeding ripeness. A similar decrease was found in the levels of mono- and diglycerides. No consistent changes occurred with the phospholipid fractions of developing wheat but the carotenoid pigments disappeared as the wheat kernel developed and matured.

The fat of hibernating animals. A. D. Popov and P. D. Mazhdrakov (Inst. of Org. Chem., Bulgarian Acad. of Sciences, Sofia, Bulgaria). *Biochem. (U.S.S.R.)* 29 (4), 550–3 (1965). The composition of fat from the hedgehog was studied. The qualitative characteristics and quantitative composition of the fat and the mixed fatty acids were determined. The fat remains liquid over a wide range of temperature (M.P. $<$ 0C) and is rich in unsaturated fatty acids. The hedgehog and ground squirrel fats are much alike and resemble fats of reptiles and amphibians rather than that of warm blooded animals.

Gas chromatography of unsaponifiable matter. III. Identification of hydrocarbons, aliphatic alcohols, tocopherols, triterpenoid alcohols and sterols present in olive oils. J. Eisner, J. L. Iverson, A. K. Mozingo and D. Firestone (Div. of Food Chem., Standards and Additives, F.D.A., Washington, D. C.). *J. Assoc. Offic. Agr. Chem.* 48, 417–33 (1965). The unsaponifiable matter of both foreign and domestic olive oil was fractionated on a Florisil column. Gas chromatography confirmed that squalene was the major component of the first two hydrocarbon fractions from pomace oils. However, *iso-* and/or *anteiso*-tetratriacontane was the major hydrocarbon in olive kernel oil. Gas chromatography of the third Florisil fraction indicates the presence of three homologous series of *normal, iso-* and/or *anteiso-*, and multiple branched chain alcohols. Triterpenoid alcohols were used to distinguish between pressed and solvent-extracted pomace oils. Campesterol and *beta*-sitosterol were the two sterols present in the olive oils.

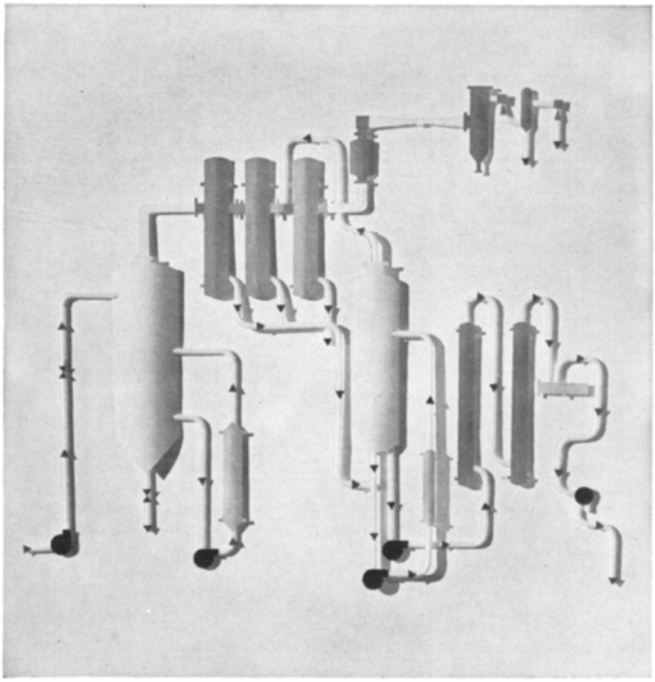
THE EFFECT OF BORON ON THE LIPID CONTENT AND DISCOLORATION OF POTATOES. N. I. Mondy, A. Bourque, B. Breslow and L. R. Mattick (Grad. School of Nutr., New York State College of Home Econ., Cornell Univ., Ithaca, New York 14850). *J. Food Sci.* 30, 420–26 (1965). Ontario, Katahdin, and Pontiac potatoes grown with and without boron foliar spray were examined for discoloration and lipid content. The lipid was fractionated into free fatty acids, neutral fat, and phospholipids. The free fatty acids from each of the three fractions were esterified and quantitatively analyzed by gas chromatography. Discoloration was measured with a Hunter color-difference meter. The total lipid of all three varieties was higher in the boron treated potatoes than in the control potatoes. The phospholipid fraction of all three varieties was higher in the boron treated potatoes, and the neutral-fat fraction was higher in Pontiac potatoes which were boron treated. Potatoes receiving boron treatment discolored less than the control potatoes.

FATTY ACID COMPOSITION OF THE PLASMA LIPIDS OF NEWBORN AND MATERNAL RUMINANTS. W. M. F. Leat (Inst. of Animal Physiol., Babraham, Cambridge). *Biochem. J.* **98**, 598–603 (1966). The fatty acid compositions of the plasma lipids of newborn unsuckled lambs, kids, calves and piglets have been determined and compared with those of maternal plasma lipids at parturition. The predominating plasma fatty acids in the newborn of all species are palmitic, stearic and oleic acids. Very small amounts of linoleic and linolenic acids are present, although considerable amounts of these acids are contained in maternal plasma. The plasma fatty acids of the newborn piglet contained 5.5% linoleic, those of the calf 2.0% and those of the lamb and kid less than 1.0%. In the lamb and kid, but not in the calf or piglet, a C-20:3 acid was detected in plasma lipids that was very similar to, if not identical with the C-20:3 acid that accumulates in the plasma of animals of given diets low in essential fatty acids. The cholesteryl esters of cow plasma were found to contain a higher percentage (43%) of linolenic acid than those of goat and sheep plasma (5–10%).

ISOMERIC METHOXY-STEARIC ACID ARTIFACTS FROM SHEEP PERINEPHRIC FAT. R. P. Hansen (Department of Sci. and Ind. Res., Wellington, New Zealand). *Chem Ind. (London)* 1966, 288. A fraction representing trace proportions of the total fatty acids has been isolated from sheep perinephric fat and identified as a mixture of methoxy-isomers (8–14) inclusive of stearic acid. The author postulates that these isomers were produced as artifacts by rigorous esterification with methanol and sulfuric acid of a large sample of sheep perinephric fatty acids which contained small amounts of constituent hydroxy-fatty acids formed from oleic acid by microbial or enzymatic action.

FRACTIONATION AND DETERMINATION OF THE LIPID AND STEROID CONSTITUENTS OF THE ADRENAL GLANDS OF RATS BY MEANS OF THIN-LAYER CHROMATOGRAPHY. R. Angelico, G. Cavina, A. D'Antona and G. Giocoli (Inst. Superiore di Sanita, Roma, Italy). *J. Chromatog.* 18, 57–68 (1965). A method is described for fractionation and determination of the lipid and steriod components in very small amounts of substrates. The sample is extracted with chloroform-methanol (2:1). The total lipid extracts were separated by thin-layer chromatography, the solvent system being benzene-ether-acetic acid (70:30:1). Spots corresponding to cholesterol esters, triglycerides, fatty acids, cholesterol and phospholipids were obtained; corticosteroids tended to lag behind in the least mobile fraction, together with the phospholipids. Corticosteroids were estimated by a colorimetric method with tetrazole blue and U. V. spectroscopy. A second chromatography was performed on the corticosteroid eluate; the solvent system was chloroform-methanol-water (90:10:0.25). A clear-cut separation of the principal corticosteroids present in the suprarenal glands of rats was obtained.

VITAMIN E AND LINOLENIC ACID CONTENT OF HAY AS RELATED TO DIFFERENT DRYING CONDITIONS. B. Thafvelin and H. E. Oksanen (Nat. Vet. Inst., Stockholm, Sweden, and College of Vet. Med., Helsinki, Finland). *J. Dairy Sci.* **49**, 282–6 (1966). During the harvesting season of 1964 the contents of vitamin



E and linolenic acid were determined in three different grass species, viz., timothy grass, red clover and tufted hair grass. The influence on the two components in timothy grass of stage of development, harvesting methods and climatic factors was studied. In timothy grass having reached the flowering stage the tocopherol content was 108 $\mu$g/gram and the linolenic acid content of its fat 49.1%, as compared to 52 $\mu$g/gram and 21.8%, respectively, in a late stage of development. The losses of vitamin E in timothy grass hay, dried on hay poles, were remarkable even under favorable weather conditions, whereas the fatty acid composition of the fat remained largely unchanged. In cocked hay a decrease in vitamin E content could be demonstrated as early as within ten days, in spite of favorable drying conditions; whereas, the linolenic acid content did not decrease until later, following a change towards rainy weather. In hay, dried as swath, there was a rapid decrease in both vitamin E and linolenic acid content even under favorable weather conditions. The rate of vitamin E destruction was greatest (nearly 60% within four days) in hay, dried in a swath and artificially moistened. The investigations also included studies on changes in iodine value and degree of oxidation of the hay fat as related to different methods for haymaking.

Proton magnetic resonance spectra of unsaturated fatty acids. J. M. Purcell, S. G. Morris and H. Susi (Eastern Reg. Res. Lab., U. S. Dept. of Agr., 600 E. Mermaid Ln., Phila. Pa.). *Anal. Chem.* 38, 588–92 (1966). The proton magnetic resonance (PMR) spectra of various unsaturated fatty acids were studied. The types of compounds studied included those in which the methylene chain is interrupted by one or more carbon-carbon multiple bonds. The spectral effects produced by the multiple bonds are discussed. Chemical shifts and, when possible, coupling constants have been determined.

Analysis of alcohols in essential oils of grapefruit, lemon, lime, and tangerine. G. L. K. Hunter and M. G. Moshonas (U. S. Fruit and Veg. Products Lab., Southern Utilization Res. and Dev. Div., U. S. Dept. of Agr., Winter Haven, Florida 3382). *J. Food Sci.* 31, 167–71 (1966). Alcohols in the cold-pressed essential oils of grapefruit, lemon, lime, and tangerine were extracted from the whole oil with glycerol, isolated by column chromatography, separated by gas chromatography, and indentified by infrared and mass spectroscopy. Nineteen alcohols were indentified in grapefruit oil, 9 in lemon, 8 in lime, and 16 in tangerine. In addition, the fungicide, *o*-phynyl phenol, was found in the oils of grapefruit and tangerine.

Oxygen removal from cottonseed oil by sparging with nitrogen. M. L. Hoffman (Res. and Dev., Liquid Carbonic Div., Gen. Dynamics Corp., Chicago, Ill., 60632). *Food Technol.* 20, 204–8 (1966). The dissolved oxygen content of cottonseed oil was reduced substantially by stripping with nitrogen gas in an experimental sparger designed to produce very small bubbles. The high gas velocity through a 1½-inch standard production sparger caused rapid coalescence of bubbles and thus reduced the interphase area necessary for mass transfer, but the experimental sparger, with a substantially larger relative amount of sparger surface, was able to handle high gas flow rates effectively. The observed reductions in dissolved oxygen content were found to be dependent on oxygen concentration, in contradiction to the assumption of first-order mass transfer. Data were correlated empirically by assuming the rate of mass transfer proportional to the *n*-th power of the oxygen pressure, where *n* was found to be 1.5.

Carbonyls in oxidizing fat. IX. Aldehydes isolated from methyl arachidonate. R. Ellis, A. M. Gaddis and G. T. Currie (Meat Lab., Eastern Utilization Res. and Dev. Div., U. S. Dept. of Agr., Beltsville, Maryland 20705). *J. Food Sci.* 31, 191–5 (1966). The monocarbonyl compounds developed by oxidation of methyl arachidonate under mild conditions were measured by three methods of isolation. Aldehydes from scission of hydroperoxides of the pentadiene system furthest removed from the carboxyl group accounted for 80% of the total, and the same ones are characteristic of oxidized linoleate. The $C_6$ alkanal was the major aldehyde and $C_7$ alkanal, a compound not readily accountable for by conventional mechanisms of autoxidation, was second in quantity. The mild Girard T and Schwartz methods broke down some precursors, but in a qualitatively different manner. The Pool and Klose alumina chromatographic method decomposed precursors, but not to the extent that has been observed in autoxidized lard. Two unsaturated aldehydes isolated by this method may be alk-2,4,6-trienals.

Determination of calcium and magnesium in animal and vegetable fats by atomic absorption. R. Guillaumin and N. Drouhin (Inst. of Fats and Oils, Paris, Fr.). *Rev. Franc. Corps Gras* 12, 735–42 (1965). Determination of calcium and magnesium by atomic absorption spectroscopy is feasible for lipids directly dissolved in an organic solvent. Direct dissolving in solvent eases preparation, reduces preparation time and reduces losses. The preferred solvent is isoamyl acetate methanol, 85:15. The limit of detection for magnesium is 5 ppb and for calcium is 250 ppb.

A new process for removal of sunflower waxes. R. Guillaumin and N. Drouhin (Inst. of Fats and Oils, Paris, Fr.). *Rev. Franc. Corps Gras* 12, 665–672 (1965). Winterizing sunflower oils is a very tedious and expensive process for the removal of waxes. In this paper is described a new technique based on the molecular structure, polarity and size of the wax molecule. The wax molecules can be absorbed under specific conditions at the interfaces of water-oil emulsion droplets. Thus, they can be separated by centrifugation. The best emulsifying agents are mixtures of tripolyphosphate or hexametaphosphate with sodium lauryl sulfate, sodium diisobutylnaphthalene sulfonate or sucrose distearate. The process is inexpensive and simple.

Application of differential thermal analysis to the study of fats. IV. Investigation of pressure and extraction cocoa butters. A. Mathieu, H. Chaveron, R. Perron and C. Paquot (Lab. of Lipochemistry of C.N.R.S.). *Rev. Franc. Corps Gras* 12, 639–46 (1965). The differential thermal analysis of pressure and of extraction cocoa butters, extracted with different solvents with or without previous acid treatment, shows that, whatever the method of obtention of these butters, a principal glyceride group of fairly constant composition exists in them. On the other hand, measuring the area of a minor peak which appears on cooling allows certain distinctions to be made between the butters studied.

Hyperoxidation in autoxidation. Part II. Some specific features and universal nature in hydroperoxidation. N. A. Kahn (East. Reg. Lab., Dacca, E. Pakistan). *Oleagineux* 20, 751–755 (1965). The four stages in autoxidation have given a place to the hydroperoxidation reaction. The electronic interpretations have added impetus to the concepts of hydroperoxidation and shown feasibilities of such reaction. The universal nature of hydroperoxidation pro-oxidant actions, antioxygenesic and the allied reactions, establish also the independent nature of hydroperoxidation that occurs ahead of free radicals by means of a series of stepwise transition states eliminating energy barriers.

Determination of sodium and potassium in fats by atomic absorption. A. Prevot and C. Barbati (Lab of Inst. of Fats and Oils, Paris, France). *Rev. Franc. Corps Gras* 12, 657–63 (1965). Amounts of alkali in fats and oils are generally less than detection limits of classical methods. Atomic absorption spectroscopy is much more sensitive. Sodium determination is of interest as a means of controlling refining. Regarding the great sensitivity of the method, special care must be taken to avoid contamination of solutions; for example, glass containers must not be used for sodium in the ppm range. Two methods have been studied. In the first, sodium is determined after extraction by water. Three extractions with water removed all the sodium. Sodium determination was made in aqueous solutions. The working curve for sodium was linear up to 4 ppm. The sensitivity limit for sodium was 3 ppb. The second method was by dilution of fats or oils solutions in an organic solvent. The sensitivity limit for the direct method is 10 ppb for sodium and 30 ppb for potassium.

Detection and estimation of adulteration of vegetable oils. T. N. Mehta and M. V. Gokhale (Laxminarayan Inst. of Tech., Univ. of Nagpur, Nagpur). *Indian Oil Soap J.* 31, 9–13 (1965). The ease with which urea forms crystalline complexes with fatty acids is related both the chain-length and the degree unsaturation. This property has been used to detect and estimate adulteration of mustard, coconut and seasame oils with peanut oil and of butter fat with Dalda vanaspati. When mustard seed oil is adulterated with peanut oil, the iodine value of the fatty acids forming urea adducts is increased and their neutralization value decreased as the proportion of mustard oil in the mixture increased. As the proportion of coconut oil in a mixture of coconut oil and peanut oil is increased, the neutralization value of the fatty acids in the adduct progressively increased and their iodine value dropped. When sesame oil is adulterated with peanut oil, the iodine value and refractive index of the adducting acids is decreased. Adulteration of butter with margarine (Dalda vanastpati) is easily detected. As the level of hydrogenated

fat is increased, the iodine value of the adducting acids is increased, the iodine value of the adducting acids increases.

Oils from fish caught in the inland sea of Japan. IV. Properties of oils from smallfish, flathead, flatfish and Canthereins modestus. Shigeru Hamada and Sei-ichi Ueno. *Yukagaku* 15, 30–2 (1966). The yield of liver oil from the bass and Cantherines was higher than that of body oil. Iodine numbers of these oils were in the range of 160–170. There was no distinct differences in composition of body oil and entrail oil as determined by gas chromatography of methyl esters of fatty acids obtained from these oils. Fatty acids were composed mainly of $C_{14}$-$C_{20}$ saturated and $C_{14}$-$C_{24}$ unsaturated acids. Unsaponifiable matter in colorless crystals had m.p. 140–5C and iodine number 150–80.

Lipids of Japanese littleneck (Tapes japonica). I. Composition of acetone-soluble lipids. Shigejiro Yasuda (Hiroshima Univ.). *Yukagaku* 15, 50–3 (1966). The composition of acetone-soluble lipids in *T. japonica* was studied from the view point of its seasonal variation. The lipids were extracted with ethanol-ether or methanol-chloroform, and acetone-soluble lipids were obtained by means of acetone-precipitation and Folch-washing method. The acetone-soluble lipids were analyzed with counter-current distribution method. Sterols and phospholipids were separated but glycerides and esters of sterols could not be separated. These components were identified by thin layer chromatography on salicic acid. The seasonal variation of the composition of acetone-soluble lipids was not great. The sterol was mainly 7-dehydrostigmasterol, but the presence of another sterol was indicated by the infrared absorption spectrum and thin-layer chromatography.

Effects of the phosphates derived by hydrolysis of the phosphatides on autoxidation rates of the water-unsaturated fatty acid ester system. Chieko Urakami, Noriko Hirosawa and Naoko Morikawa (Osaka City Univ.). *Yukagaku* 15, 7–12 (1966). All the esters in 0.0006 mM solution at pH 4 showed prooxidant activities instead of antioxidant. Glycerylphosphorylserine showed the strongest activity at pH 5.5, followed by phosphorylcholine (PC). Glycerophosphorylcholine (GPC) showed the activity comparable to that of glycerylphosphoric acid (GP), which is generally active in various fatty acid esters, whereas phosphorylethanolamine (PE) and glycerylphosphorylethanolamine (GPE) exhibited no antioxidant activity, GPC was found to be strongly active at pH 9.6 in comparison with PE, PC and $\beta$-GP. Trimethyl and triethyl phosphates showed antioxidant activity at pH 5.5, while the pH at which tributyl phosphate showed activity was lower. The following percentages may be taken as possible optimum concentrations in the water-methyl linoleate system: fresh GP 0.03%, fresh PE 0.03–0.04%, fresh PC 0.03%, fresh GPE 0.04%, and fresh or somewhat oxidized GPC 0.03–0.05%.

Color development of frying oil during heating. II Mechanism of color of methyl linoleate. Akira Mukai and Shizuyuki Ota (Ajinomoto Co., Kawasakishi). *Yukagaku* 15, 58–64 (1966). Methyl linoleate was selected as a typical model component of frying oil. The sample was heated for 8 hours at 200C and the time dependence of chromaticity and characteristic changes was determined. Greater changes were observed in methyl linoleate than in soybean oil. The highly colored sample was divided into five fractions by the urea adduct method and each fraction was tested. The composition and mean molecular weight of the compounds which did not form the urea adduct were determined and the presence of cyclic structure was confirmed. Isolated *cis* double bonds were isomerized to *trans* double bond on heating and this was followed by the formation of the *cis-trans* and *trans-trans* conjugation of isolated double bonds. Highly colored fractions were found to contain *trans* and *trans-trans* conjugated double bonds. Dimerization and trimerization occurred accompanied by the formation of carbonyl, hydroxyl and epoxy groups. Colored materials which were composed of partly cyclic dimers and trimers were concentrated in the fraction which did not give the urea adduct. The polar dimer containing oxygen was found to give deeper red coloration.

Automatic measurement of water content in water-in-oil emulsions. Takeshige Fukushima and Tadatsugu Itoh. *Yukagaku* 15, 116–17 (1966). The water content in water-in-oil emulsions was measured automatically by measuring capacitance in such emulsions due to the change of water content. Accuracies are better than ± 0.1% in water content up to 5% in the usual lubricating oils. The apparatus consists of 1 kc. oscillator, transformer bridge, phase detector, Schmitt trigger circuit and relay. For recording, the measuring condenser is rotated at a constant speed. The signal from relay is also available to give an alarm or orders to control system, if the measuring condenser is previously fixed at a desired value.

Antarctic whale oils by gas-liquid chromatography using a hydrogen flame ionization detector. III. Analysis of the fatty acids from fin whale blubber oil. Yoshihiko Sano (Miyoshi Oil & Fat Co., Tokyo). *Yukagaku* 15, 99–108 (1966). Components fatty acids, obtained from the antarctic fin whale blubber oil, have been determined by gas-liquid chromatography (GLC) using a hydrogen ionization detector. The refined oil was converted directly into methyl esters by alkali-catalyzed methanolysis, and the methyl esters were separated by silicic acid column chromatography, urea-complex fractionation and preparative silica gel thin-layer chromatography. Each fraction was then analyzed by GLC before and after hydrogenation. Qualitative or semi-quantitative evidence showed the presence of numerous fatty acids ranging from 12 to 24 carbon atoms in chain length in the sample oil as well as in sei whale oil. Of special interest were the polyunsaturated, odd-numbered fatty acids (19:5 and 21:5) and the existence of multi-branched chain and unsaturated branched-chain fatty acids.

A.O.M. stability of modified whale oils. Yoshiro Abe, Hajime Seino, Twuan Yang Lee and Katsuji Suzuki (Keio Univ., Tokyo). *Yukagaku* 15, 94–9 (1966). Studies have been made on the preparation of odorless and colorless marine oils by means of molecular distillation. One of the problems in using this distilled oil is low stability due to its high content of double bonds. The polymerization of whale oil has been investigated as a means of increasing its stability by decreasing the number of double bonds before molecular distillation. Whale oil was polymerized by heating at 170C or 260C in the presence of activated earth under nitrogen. Polymerization proceeded at 260C and the A.O.M. stability of oil increased as the iodine value decreased, whereas the oil was not polymerized at 170C. Unsaponifiables of vegetable oil were added to several kinds of modified oil (whale oil free from unsaponfiables by molecular distillation, refined whale oil and polymerized whale oil), and A.O.M. stabilities were determined. The addition of vegetable oil unsaponifiable matter was effective for the stabilization of whale oil, especially for the hydrogenated oil. Soybean oil unsaponifiable matter was more effective than any other.

Chemical changes occurring in oils during frying. A. Montefredine (Prov. Chem. Lab., Pescara, Italy). *Riv. Ital. Sostanze Grasse* 42, 482–7 (1965). In a study conducted on several vegetable oils, as well as margarine and lard, up to 30 consecutive batches of potatoes have been deep-fried in the same batch of oil, according to a standardized procedure. Oil samples taken after the 15th and 30th frying run and also oil extracted from the fried potatoes have been analyzed to determine what chemical modifications of the oil accompany the frying process. The most noticeable and consistent change in all of the oils examined is a very pronounced increase in the U.V. absorption at 232 m$\mu$ (dienes), with a corresponding but smaller increase in the 268 m$\mu$ absorption (trienes). Free acidity does not vary through the 30 frying operations and the peroxide number also remains about constant, except in the case of oils with high initial values, where there is a considerable lowering of this latter index during frying. The IV of all oils shows a definite downward trend, however, the IV drops are relatively moderate: 1–4%. It is not yet possible, on the basis of these results, to interpret all of the chemical modifications that take place in an oil during frying.

Detection of esterfied olive oils by capillary column gas chromatography. L. Boniforti and R. Monacelli (Ist. Super. di Sanita, Rome, Italy). *Riv. Ital. Sostanze Grasse* 42 493–6 (1965). The usefulness of the gas chromatographic method on capillary columns for detecting *trans* iso-oleic acid has been confirmed. A method for measuring the ration between the elaidinic and stearic acid is proposed.

Determination of elaidinic acid in vegetable oils. U. Pallotta and G. Losi (Univ. of Bologna, Italy). *Riv. Ital. Sostanze Grasse* 42, 538–41 (1965). Details of a method for de-