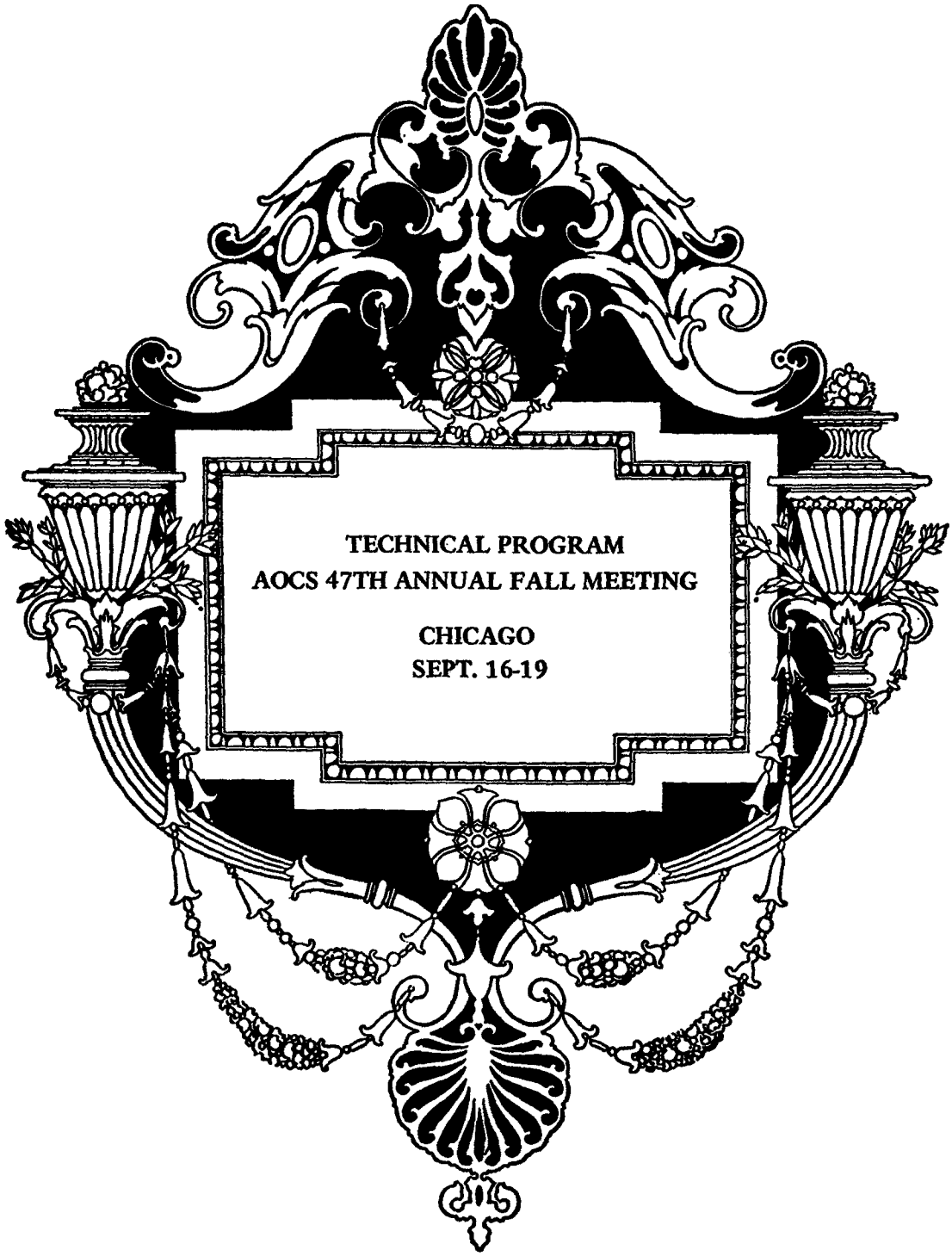
TECHNICAL PROGRAM
AOCS 47TH ANNUAL FALL MEETING
CHICAGO
SEPT. 16-19

MONDAY MORNING—SEPTEMBER 16

10:00 A.M.—Windsor Room

SESSION A—GENERAL: LIPID OXIDATION

Chairman—**B.F. Szuhaj,** Central Soya Co., Chicago, Ill.

10:30 INTRODUCTORY REMARKS

10:35 1. **OXIDATION AND QUALITY OF SOYBEAN OIL FROM SOUND AND FIELD-DAMAGED BEANS: ANISIDINE TEST**
G.R. List, C.D. Evans, K. Warner, B.K. Boundy and J.C. Cowan, Northern Regional Research Lab.

10:55 2. **ANTIOXIDANTS IN SILICONE-TREATED FRYING OILS**
E.R. Sherwin, Eastman Chemical Products, Inc.

11:15 3. **RELATIVE EFFECTIVENESS OF NATURAL AND SYNTHETIC ANTIOXIDANTS IN TWO MODEL SYSTEMS SIMULATING LOW MOISTURE FOODS**
William L. Porter, S.J. Bishov, L.A. Levasseur and A.S. Henick, U.S. Army Natick Labs.

11:35 4. **TOCOPHEROL STABILITIES IN OXIDIZING SYSTEMS. INTERACTIONS AMONG ALPHA, GAMMA AND DELTA TOCOPHEROLS**
Joanna Lehmann and Hal T. Slover, Lipid Nutrition Lab., NI, ARS, USDA

MONDAY MORNING—SEPTEMBER 17

10:00 A.M.—Lincoln Room

SESSION B—GENERAL: BIOCHEMISTRY

Chairman—**R. Rouser,** City of Good Hope Medical Center, Duarte, Calif.

10:30 INTRODUCTORY REMARKS

10:35 5. **LIPID SYNTHESIS BY PERFUSED LUNG**
E.G. Tombropoulos and J.G. Hadley, Battelle Pacific Northwest Labs.

10:55 6. **STUDIES ON FATTY ACID SYNTHESIS IN RAT TESTIS**
A. Richard Whorton and John G. Coniglio, Vanderbilt University School of Medicine

11:15 7. **PERIPHERAL NERVE MYELIN IN EXPERIMENTAL DIABETES AND IN AGING**
H. Singh, N. Spritz and B. Geyer, New York University School of Medicine and Lipid Metabolism Lab., V.A. Hospital

11:35 8. **EFFECT OF STERCULIC ACID ON AFLATOXICOSIS IN RATS FED DIETS CONTAINING SATURATED OR UNSATURATED FAT**
Penelope Wells, Lilla Aftergood and Roslyn Alfin-Slater, University of California School of Public Health

MONDAY MORNING—SEPTEMBER 17

10:00 A.M.—Florentine Room

SESSION C—GENERAL: ANALYTICAL METHODS

Chairman—**R.H. Bowers,** Swift & Co., Oak Brook, Ill.

10:30 INTRODUCTORY REMARKS

10:35 9. **APPLICATION OF NMR SPECTROSCOPY FOR DETERMINATION OF TRIGLYCERIDE CONTENT IN MARINE WAX-ESTER OILS**
P.J. Ke, R.G. Ackman and D. Hooper, Fisheries Research Board, Halifax Lab.

10:55 10. **STRUCTURE ANALYSIS OF α-BRANCHED CHAIN FATTY ACIDS BY GAS CHROMATOGRAPHY AND MASS SPECTROSCOPY**
T.A. Foglia, P.A. Barr and I. Schmeltz, Eastern Regional Research Center, ARS, USDA

11:15 11. **QUANTITATIVE MEASUREMENT OF CLING OF HOUSEHOLD PLASTIC WRAPS**
Lyle Hendrickson and Henry D. Cross, III. Colgate-Palmolive Co.

11:35 12. **ANALYSIS AND MONITORING OF TRANS-ISOMERIZATION BY ATR SPECTROPHOTOMETRY**
H.J. Dutton, Northern Regional Research Lab.

11:55 13. **CHROMATOGRAPHIC SEPARATION AND IDENTIFICATION OF NYLON-9 INTERMEDIATES DERIVED FROM SOYBEAN OIL**
W.L. Kohlhase, W.E. Neff, R.A. Awl, E.H. Pryde and J.C. Cowan, Northern Regional Research Lab.

MONDAY MORNING—SEPTEMBER 17

10:00 A.M.—Plaza Room

SESSION D—GENERAL: ORGANIC CHEMISTRY

Chairman—**R.S. Klonowski,** Swift & Co., Oak Brook, Ill.

10:30 INTRODUCTORY REMARKS

10:35 14. **ETHYLENE AND DIMETHYL ACETALS FROM HYDROFORMYLATED LINSEED, SOYBEAN AND SAFFLOWER METHYL ESTERS AS PLASTICIZERS FOR PVC**
R.A. Awl, R.N. Frankel and E.H. Pryde, Northern Regional Research Lab., and G.R. Riser, Eastern Regional Research Lab.

11:05 15. **9(10)-CARBOXYOCTADECYLAMINE AND 9(10)-AMINOMETHYLOCTADECANOIC ACID. SYNTHESIS AND POLYMERIZATION TO POLYAMIDES WITH LATERAL SUBSTITUTION**
W.R. Miller, W.E. Neff, E.N. Frankel and E.H. Pryde, Northern Regional Research Lab.

11:35 16. **NONCRYSTALLINE POLYAMIDES AND COPOLYAMIDES FROM 9(10)-CARBOXYSTEARIC ACID**
W.L. Kohlhase, E.N. Frankel, E.H. Pryde and J.C. Cowan, Northern Regional Research Lab.

MONDAY AFTERNOON—SEPTEMBER 17

2:00 P.M.—Windsor Room

SESSION E—SYMPOSIUM: STATUS OF FAT IN FOOD AND NUTRITION

Chairman—**E.E. Rice,** Swift & Co., Oak Brook, Ill.

2:00 INTRODUCTORY REMARKS

2:10 17. **FATS IN TODAY'S FOOD SUPPLY—LEVEL OF USE AND SOURCES**
Robert L. Rizek, Consumer and Food Economics Institute, ARS, USDA

2:40 18. **ROLE OF LIPIDS IN HEALTH AND DISEASE**
Richard J. Jones, University of Chicago

3:10 19. **CURRENT STUDIES ON RELATION OF FAT TO HEALTH**
F.A. Kummerow, University of Illinois, Burnsides Research Lab.

3:40 20. **POSSIBLE EFFECTS OF LABELING REGULATIONS OF FAT IN THE DIET**
Jerry Proctor, Kraftco Corp.

4:10 21. **MODIFICATION OF FOOD TO CONTROL FAT CONTENT**
V.K. Babayan, Stokley-Van Camp, Inc.

4:40 DISCUSSION

MONDAY AFTERNOON—SEPTEMBER 17

2:00 P.M.—Lincoln Room

SESSION F—GENERAL: BIOCHEMISTRY

Chairman—**H. Schlenk,** Hormel Institute, University of Minnesota, Austin

2:00 INTRODUCTORY REMARKS

2:05 22. **DDT ABSORPTION AND LIPOPROTEIN TRANSPORT IN THE RAT**
Dorothy M.E. Pocock, McGill University Medical Clinic, and Alan Vost, Montreal General Hospital

2:35 23. **WAX ESTERS IN FISH: METABOLISM OF DIETARY WAX ESTERS IN THE GOURAMI**
H. Schlenk, D.M. Sand and C. Rahn, University of Minnesota

3:05 24. **WAX ESTERS IN FISH: OXIDATION OF FATTY ALCOHOL TO ALDEHYDE AND ACID IN GOURAMI CAECA HOMOGENATES**
D.M. Sand, T.W. Griffith and H. Schlenk, University of Minnesota

3:35 25. **WAX ESTERS IN FISH: REDUCTION OF FATTY ACIDS AND FORMATION OF WAX ESTERS IN GOURAMI ROE HOMOGENATES**
T.W. Griffith, D.M. Sand and H. Schlenk, University of Minnesota

MONDAY AFTERNOON—SEPTEMBER 17

2:00 P.M.—Florentine Room

SESSION G—GENERAL: ANALYTICAL CHEMISTRY

Chairman—**L.D. Metcalfe,** ARMAK Co. McCook, Ill.

2:00 **INTRODUCTORY REMARKS**

2:05 26. **RAPID DETERMINATION OF PROTEIN IN SOYBEAN MEALS BY PLANT OPERATORS**
Frank J. Pease, A. E. Staley Manufacturing Co.

2:25 27. **EVALUATION OF METTLER AUTOMATIC DROPPING POINT APPARATUS AND STATISTICAL COMPARISON WITH WILEY MELTING POINT METHOD**
W.G. Doeden, Swift & Co., R&D Center

2:45 28. **INFLUENCE OF CARBOXYL GROUP SUBSTITUENTS UPON MASS SPECTRA OF UNSATURATED FATTY ACID MOIETIES**
Bengt A. Andersson and Ralph T. Holman, University of Minnesota

3:05 29. **BUNSEN COEFFICIENT FOR OXYGEN IN MARINE OILS AT VARIOUS TEMPERATURE DETERMINED BY AN EXPONENTIAL DILUTION METHOD WITH A POLAROGRAPHIC OXYGEN ELECTRODE**
P.J. Ke and R.G. Ackman, Fisheries Research Board, Halifax Lab.

3:25 30. **THERMAL PROPERTIES OF PLASTIC SOLIDS OBTAINED BY TALLOW FRACTIONATION**
J.W. Hampson, F.E. Luddy, S.F. Herb and H.L. Rothbart, Eastern Regional Research Center, ARS, USDA

3:45 31. **PULSE NMR— HIGHLY AUTOMATED METHOD FOR DETERMINING SOLID FAT CONTENT IN PARTIALLY CRYSTALLIZED FAT**
K. van Putte and J.C. van den Enden, Unilever Research

4:05 31A. **DETERMINATION OF EMULSION STABILITY BY MICROWAVE HEATING**
Gary E. Petrowski, Carnation Research Labs.

MONDAY AFTERNOON—SEPTEMBER 17

2:00 P.M.—Plaza Room

SESSION H—GENERAL: ORGANIC CHEMISTRY

Chairman—**R.S. Klonowski,** Swift & Co., Oak Brook, Ill.

2:00 **INTRODUCTORY REMARKS**

2:05 32. **DECARBONYLATION OF UNSATURATED ACID CHLORIDES**
P.A. Barr, T.A. Foglia and I. Schmeltz, Eastern Regional Research Center, ARS, USDA

2:35 33. **STUDY OF COLOR STABILITY OF TALL OIL FATTY ACIDS THROUGH ISOLATION AND CHARACTERIZATION OF MINOR CONSTITUENTS**
David B.S. Min and Stephen S. Chang, Rutgers, The State University

3:05 34. **γ-RADIOLYSIS OF CRYSTALLINE STEARIC ACID**
Guey-Shuang Wu and David R. Howton, University of California, Los Angeles

3:35 35. **PROPERTIES AND UTILITY OF PETROLEUM-DERIVED SECONDARY ALKYL AMINES**
J.H. Kolain and M.D. Riordan, Texaco, Inc.

TUESDAY MORNING—SEPTEMBER 18

9:00—Florentine Room

SESSION I—SYMPOSIUM: SOLVENT EXTRACTION TECHNIQUES

Chairman—**J.E. Heilman,** Allied Mills, Inc., Chicago, Ill.

9:00 **INTRODUCTORY REMARKS**

9:05 36. **GRAIN CLEANING AND SCREENING**
Alex C. Young, The Orville Simpson Co.

9:35 37. **GRAIN DRYING**
James F. Kelly, Aeroglide Corp.

10:05 38. **DEHULLING**
Russell W. Kice, Kice Metal Products Co., Inc.

10:35 39. **FLAKING**
N. Hunt Moore, N. Hunt Moore & Associates

11:05 40. **EXTRACTION—HISTORY AND TECHNIQUES**
William A. Barger, French Oil Mill Machinery Co.

11:35 41. **DISTILLATION AND SOLVENT RECOVERY**
E. Milligan, EMI Corp.

TUESDAY MORNING—SEPTEMBER 18

9:30 A.M.—Windsor Room

SESSION J—SYMPOSIUM: TOXICOLOGY AND BIOCHEMISTRY OF FOOD ADDITIVES USED IN FATS AND OILS

Chairman—**A.L. Branen,** University of Wisconsin

9:30 **INTRODUCTORY REMARKS**

9:40 42. **CONSUMER ADVOCATE'S VIEW OF FOOD ADDITIVES**
Michael F. Jacobson, Center for Science in the Public Interest

10:10 43. **ECONOMICS OF FOOD ADDITIVES**
John Angeline, A.D. Little

10:40 44. **SAFETY OF EMULSIFIERS IN FATS AND OILS**
Neil R. Artman, Procter & Gamble Co.

11:10 45. **TOXICITY OF EDTA**
Franklin A. Ahrens, Iowa State University

TUESDAY MORNING—SEPTEMBER 18

9:30 A.M.—Lincoln Room

SESSION K—GENERAL: BIOCHEMISTRY

Chairwoman—**R.B. Alfin-Slater,** University of California, Los Angeles

9:30 **INTRODUCTORY REMARKS**

9:35 46. **AMNIOTIC FLUID PHOSPHOLIPIDS IN NORMAL, DIABETIC AND DRUG ABUSE HUMAN PREGNANCY**
Eric J. Singh, Frederick P. Zuspan and Alfonso Mejia, University of Chicago

10:05 47. **INFLUENCE OF EFA NUTRITION AND CPIB ON TESTICULAR PATHOLOGY AND FATTY ACID CONTENT**
Ian J. Tinsley and Robert R. Lowry, Oregon State University

10:35 48. **SOME PHYSIOLOGIC AND MORPHOLOGIC EFFECTS OF TUNG OIL**
J.C. McPherson, Jr., M. Sharawy and T.R. Dirksen, Medical College of Georgia

11:05 49. **EFFECTS OF EXOGENOUS SATURATED FAT AND CHOLESTEROL WITH OR WITHOUT ESSENTIAL FATTY ACIDS ON ERYTHROCYTE LIPIDS IN DOGS**
Antanas Butkus and L. Allen Ehrhart, Cleveland Clinic Foundation

TUESDAY MORNING—SEPTEMBER 18

9:30 A.M.—Plaza Room

SESSION L—SYMPOSIUM: HEAVY DUTY LIQUID DETERGENTS

Chairman—**I.R. Schmolka,** BASF Wyandotte Corp., Wyandotte, Mich.

9:30 INTRODUCTORY REMARKS

9:40 50. NO-PHOSPHATE LIQUID LAUNDRY DETERGENTS: CORRELATION BETWEEN CHEMICAL CONSTITUTION AND DETERGENCY OF ALCOHOL ETHOXYLATES AND ETHOXYSULFATES
D.W. Bisacchi, J.C. Illman, T.B. Albin, W.T. Shebs and H. Stupel, Shell Development Co.

10:10 51. ROLE OF STABILIZERS IN HEAVY DUTY LIQUID DETERGENTS
R.L. Liss and J.N. Huggins, Monsanto Co.

10:40 52. FLUORESCENT WHITENING AGENTS IN HEAVY DUTY LIQUID DETERGENTS
J.I. Gerko, American Cyanamid

11:10 53. ROLE OF SILICATES IN HEAVY DUTY LIQUID DETERGENTS
D.L. Muck, Philadelphia Quartz

TUESDAY AFTERNOON—SEPTEMBER 18

2:00 P.M.—Florentine Room

SESSION M—SYMPOSIUM: SOLVENT EXTRACTION TECHNIQUES

Chairman—**C.L. Kingsbaker,** Blaw-Knox Chemical Plants, Inc.

2:00 INTRODUCTORY REMARKS

2:05 54. DESOLVENTIZING TOASTING
R. Good, Blaw-Knox Chemical Plants, Inc.

2:35 55. ART OF OILSEED MEAL GRINDING
George R. Thomas, Prater Industries, Inc.

3:05 56. DUST COLLECTION
Ken Luce, Carter Day Co.

3:35 57. REVISIONS TO NFPA NO. 36—SOLVENT EXTRACTION PLANTS
John E. Heilman, Allied Mills, Inc.

TUESDAY AFTERNOON—SEPTEMBER 18

2:00 P.M.—Windsor Room

SESSION N—SYMPOSIUM: TOXICOLOGY AND BIOCHEMISTRY OF FOOD ADDITIVES USED IN FATS AND OILS

Chairman—**A.L. Branen,** University of Wisconsin, Madison

2:00 INTRODUCTORY REMARKS

2:05 58. SAFETY EVALUATION AND BIOCHEMICAL BEHAVIOR OF MONOTERTIARY BUTYL HYDROQUINONE (TBHQ)
B.D. Astill, C.J. Terhaar, W.J. Krasavage, G.L. Wolf, R.L. Roudabush, D.W. Fassett and K.E. Morgareidge, Eastman Kodak Co.

2:35 59. BIOCHEMISTRY AND TOXICITY OF BUTYLATED HYDROXYTOLUENE (BHT) AND BUTYLATED HYDROXYANISOLE (BHA)
A.L. Branen, University of Wisconsin

3:05 60. SOME CONSIDERATIONS OF USE AND ABUSE OF VITAMIN A
E.M. Blendermann and J.U. Boehne, Nutrition Div., FDA

3:35 61. NEW ASPECTS OF VITAMIN D METABOLISM AND FUNCTION
H.F. DeLuca, University of Wisconsin

4:05 62. VITAMIN E AS A FOOD ADDITIVE
Lloyd A. Witting, Texas Woman's University

TUESDAY AFTERNOON—SEPTEMBER 18

2:00 P.M.—Lincoln Room

SESSION O—GENERAL: BIOCHEMISTRY

Chairman—**J.G. Coniglio,** Vanderbilt University, Nashville, Tenn.

2:00 INTRODUCTORY REMARKS

2:05 63. ACETYLENIC FATTY ACIDS IN MOSSES
H. Schlenk, B.A. Anderson, W.H. Anderson, J.R. Chipault, E.C. Ellison, S.W. Fenton, J.L. Gellerman and J.M. Hawkins, University of Minnesota

2:35 64. LIPID COMPOSITION OF PSEUDOMONAS AERUGINOSA RESISTANT AND SENSITIVE ANTIBIOTICS
H. Singh, A.R. Shalita, J.J. Rahal and C. Hapcock, New York University of Medicine

3:05 65. CHROMANONES IN CALOPHYLLUM BRASILIENSE SEED OIL
R.D. Plattner, G.F. Spencer, D. Weisleder and R. Kleiman, Northern Regional Research Lab.

3:35 66. HYDROLYSIS OF TRIACYLGLYCEROLS, CONTAINING Δ9-TETRADECENOIC, Δ5-TETRADECENOIC ACID OR ARACHIDONIC ACID, BY GEOTRICHUM CANDIDIUM LIPASE
Robert E. Pitas and Robert G. Jensen, University of Connecticut

TUESDAY AFTERNOON—SEPTEMBER 18

2:00 P.M.—Plaza Room

SESSION P—SYMPOSIUM: HEAVY DUTY LIQUID DETERGENTS

Chairman—**Tom Edwards,** Amway Corp., Ada, Mich.

2:00 INTRODUCTORY REMARKS

2:05 67. RECENT DEVELOPMENTS IN LIQUID DETERGENT HYDROTROPES
M. Mausner, Witco Chemical Corp.

2:35 68. ORGANIC CHELATES AS BUILDERS FOR HEAVY DUTY LIQUID DETERGENTS
C.S. Johnson and J.R. Hart, Hampshire Chemical Div. of W. R. Grace

3:05 68A. ZERO PHOSPHATE LAUNDRY DETERGENTS: FORMULATION APPROACH USING PVP AND GANTREZ POLYMERS
P.M. Chakrabarti, GAF Corp.

3:35 69. HOME ECONOMIST'S LOOK AT HEAVY DUTY LIQUID DETERGENT
J. Creole, Lever Bros. Co.

4:05 70. SOAP-BASED DETERGENTS: VII. α-SULFOFATTY ALKANOLAMIDES AS LIME SOAP DISPERSANTS
Frank D. Smith, J.K. Weil and W.M. Linfield, Eastern Regional Research Center, ARS, USDA

4:35 71. DEVELOPMENT AND TESTING OF PHOSPHATE-FREE HOME MACHINE DISHWASHING DETERGENTS
T.M. Kaneko, BASF Wyandotte Corp.

WEDNESDAY MORNING—SEPTEMBER 19

9:30 A.M.—Plaza Room

SESSION Q—GENERAL

Chairman—**R.A. Reiners,** CPC International, Argo, Ill.

9:30 INTRODUCTORY REMARKS

9:35 72. EFFECT OF DIFFERENT FATS AND OILS ON FLAVOR OF DEEP FAT-FRIED FOODS
Michael M. Blumenthal and Stephen S. Chang, Rutgers, The State University

9:55 73. **PILOT PLANT AND COMMERCIAL SCALE REMOVAL OF AFLATOXINS**

J.P. Helme and Andre Prevot, *Institut des Corps Gras*

10:15 74. **PROPERTIES OF SOME GLYCEROL GLUCOSIDE PALMITATES**

R.O. Feuge, John L. White and Mona Brown, Southern Regional Research Center, ARS, USDA

10:35 75. **EFFECT OF 2-OLEODIPALMITIN AND 2-ELAIDODIPALMITIN ON POLYMORPHIC BEHAVIOR OF COCOA BUTTER**

N.V. Lovegren, M.S. Gray and R.O. Feuge, Southern Regional Research Center, ARS, USDA

10:55 76. **ISOMERIZATION DURING HYDROGENATION: VII. INDEPENDENCE OF SR AND ISOMERIZATION ABILITY OF NICKEL CATALYSTS**

Robert R. Allen and Jesse E. Covey, Anderson Clayton Foods

11:15 77. **FURTHER DEVELOPMENTS IN VEGETABLE OIL PROCESSING**

Karl W. Klein and Lois S. Crauer, DeLaval Separator Co.

11:35 77A. **ROLE AND FUNCTION OF POLYELECTROLYTES AND COAGULANT AIDS AND WATER POLLUTION CONTROL**

John Hughes, American Colloid

WEDNESDAY MORNING—SEPTEMBER 18

9:30 A.M.—Lincoln Room

SESSION R—GENERAL: BIOCHEMISTRY

Chairman—**V.C. Witte**, Swift & Co., Oak Brook, Ill.

9:30 **INTRODUCTORY REMARKS**

9:35 78. **ENHANCEMENT OF LIPOGENIC ENZYME ACTIVITIES IN RAT LIVER MICROSOMES**

Jerry Darsie and Ralph Holman, University of Minnesota

10:05 79. **ANTIMICROBIAL ACTION OF ESTERS OF POLYHYDRIC ALCOHOLS**

Anthony J. Conley and Jon J. Kabara, Michigan State University

10:35 80. **HYDROCARBON COMPOSITION OF HAIR LIPIDS FROM CAUCASIAN AND NEGRO BOYS**

Leon L. Gershbein and K.L. Sheladia, Northwest Institute for Medical Research

11:05 81. **LIPIDS OF GREEN AND ROASTED COFFEES**

Leon L. Gershbein and K. Baburao, Northwest *Institute for Medical Research*

WEDNESDAY MORNING—SEPTEMBER 19

9:30 A.M.—Florentine Room

SESSION S—GENERAL: ANALYTICAL METHODS

Chairman—**H.W. Jackson**, Kraftco Corp., Glenview, Ill.

9:30 **INTRODUCTORY REMARKS**

9:35 82. **COMPARISON OF LIPOXIDASE ENZYMES FROM VARIOUS SUPPLIERS IN DETERMINATION OF ESSENTIAL FATTY ACIDS IN EDIBLE OILS**

Robert C. Mees and William R. Purvis, Lever Bros. Co.

9:55 83. **ASSESSMENT OF LIPOLYSIS BY DIRECT GAS CHROMATOGRAPHY OF REACTION PRODUCTS ON POLAR COLUMNS**

N. Morley, A. Kuksis and J.J. Myher, Banting and Best Dept. of Medical Research

10:15 84. **APPLICATION OF HIGH SPEED LIQUID CHROMATOGRAPHY TO ANTIOXIDANT DETERMINATIONS**

R.H. Bowers, Swift & Co.

10:35 85. **DETECTION OF ALDEHYDES IN TLC WITH 4-AMINO-3-HYDRAZINO-5-MERCAPTO-1, 2, 4-TRIAZOLE (AHMT)**

C.H. Rahn and H. Schlenk, University of Minnesota

10:55 86. **FLAVOR SCORE CORRELATION WITH PENTANAL AND HEXANAL CONTENTS OF VEGETABLE OILS**

H.P. Dupuy, J.I. Wadsworth and G.E. Goheen, Southern Regional Research Center, ARS, USDA, and C.D. Evans, K.A. Warner and G.R. List, Northern Regional Research Center, ARS, USDA

ABSTRACTS OF PAPERS

1

OXIDATION AND QUALITY OF SOYBEAN OIL FROM SOUND AND FIELD-DAMAGED BEANS: ANISIDINE TEST. G.R. LIST, C.D. EVANS, K. WARNER, B.K. BOUNDY and J.C. COWAN, Northern Regional Research Lab., 1815 N. University, Peoria, Ill. 61604.

The anisidine test (U. Holm, ISF Congress, Goteborg, Sweden, 1972), a measure of secondary oxidation products in glyceride oils, was applied to a number of soybean oil samples taken from various stages of laboratory and commercial processing. Tests showed that crude oils from sound beans had low anisidine values, i.e., 0.5. In contrast, crude oil from field-damaged beans often had anisidine values that ranged from 1.0 to 4.0. The anisidine test confirmed that bleaching is the most detrimental step in processing oils whether from normal or field-damaged beans. Although bleaching increased anisidine values of both oils, deodorization generally lowered these values of salad oils prepared from sound beans, whereas little or no reduction in them was observed with salad oils from field-damaged beans. Further evidence that oxidation is a factor came from organoleptic evaluations. A highly significant correlation (—0.89**) was found between initial flavor scores and anisidine values. Flavor scores increased when anisidine decreased. The effects of fluorescent light and accelerated storage on quality and anisidine values were investigated.

2

ANTIOXIDANTS IN SILICONE-TREATED FRYING OILS. E.R. SHERWIN, Eastman Chemical Products, Inc., DPI Div., P.O. Box 431, Kingsport, Tenn. 37662.

Certain organopolysiloxanes (silicones) commonly are added to edible oils to serve primarily as antifoam agents when the oils are used in frying of foods. In view of the fact that such silicone-containing frying oils frequently are treated with antioxidants, a laboratory study was undertaken to determine what effect, if any, the silicone antifoam agents might have on the performance of antioxidants such as butylated hydroxyanisole, propyl gallate and tertiary butylhydroquinone in the frying oils. The rate of depletion of antioxidants from the oil during use as a frying medium was found to be reduced measurably when silicone was present at low levels of 10 ppm or less in the oil. Potato chips cooked in the oil were found to have improved shelf life, apparently as a results of better to have improved shelf life, apparently as a result of better retention of antioxidants in the silicone-treated frying oil.

3

RELATIVE EFFECTIVENESS OF NATURAL AND SYNTHETIC ANTIOXIDANTS IN TWO MODEL SYSTEMS SIMULATING LOW MOISTURE FOODS. WILLIAM L. PORTER, S.J. BISHOV, L.A. LEVASSEUR and A.S. HENICK, Food Chemistry Div., Food Lab., U.S. Army Natick Lab., Natick, Mass. 01760.

The relative effectiveness of several natural and synthetic antioxidants has been tested in two different dry model systems designed to simulate the exposure of the lipids in low moisture foods. One system is composed of a linoleic acid monolayer adsorbed from petroleum ether on silica gel and oxidized at 80 C in air. Twelve antioxidants were preadsorbed from ethanol solution, and the effectiveness of each relative to tocopherol was calculated from the ratio of induction periods, defined as time required to reach a headspace oxygen content of 20.0%. Comparison was on a molar basis. An entirely different system is composed of tocopherol-free corn oil, adsorbed onto carboxymethylcellulose from water emulsion and subsequently freeze-dried and oxidized in air at 65 C. In this system the antioxidants were emulsified in 2% ethanol-water, and carboxymethylcellulose was added prior to the addition of the corn oil and final blending and freeze drying. Relative effectiveness was calculated on a weight basis from the time to reach 10.5% headspace oxygen. The two systems are complementary and demonstrate the comparative utility of antioxidants.

4

TOCOPHEROL STABILITIES IN OXIDIZING SYSTEMS: INTERACTIONS AMONG ALPHA, GAMMA AND DELTA TOCOPHEROLS. JOANNA LEHMANN and HAL T. SLOVER, Lipid Nutrition Lab., NI, ARS, USDA, Agricultural Research Center-East, Beltsville, Md. 20705.

The stabilities of alpha, gamma, delta, alpha + gamma, and alpha + delta tocopherols were determined in methyl myristate and methyl linoleate during autoxidation and anaerobic photoxidation. Solutions containing 0.05% of each tocopherol were subjected to UV light (254 nm) or to a flow of 4.8 ml/min of oxygen, both at 70 C. Tocopherols were determined by gas chromatography as trimethylsilyl ethers, without preliminary separation or purification. The relative stabilities of the three forms and their interactions were evaluated. In methyl myristate, alpha tocopherol was highly effective in protecting gamma and delta tocopherols during both photoxidation and autoxidation. In methyl linoleate, alpha afforded protection to gamma and delta during photoxidation, but not during autoxidation. There was no significant protection of alpha by either gamma or delta under any of the conditions used.

5

LIPID SYNTHESIS BY PERFUSED LUNG. E.G. TOMBROPOULOS and J.G. HADLEY, Biology Dept. Battelle Pacific Northwest Labs., P.O. Box 999, Richland, Wash. 99352.

An isolated lung ventilated with negative pressure and perfused through the pulmonary vasculature was utilized for the study of phosphatidylcholine synthesis. The perfusion medium consisted of Krebs-Ringer phosphate buffer with 6% bovine serum albumin, pH 7.4., and the appropriate substrate. The simultaneous incorporation of (CH_3-^{14}C) choline and (CH_3-^{3}H) methionine were examined. From these experiments we concluded: (1) Lung tissue synthesizes phosphatidylcholine via the diglyceride (de novo) pathway to a greater extent than any other lipid examined. (2) The nitrogenous base of phosphatidylcholine is formed by both of the major pathways with the choline pathway accounting for 50–70% of the observed incorporation and the methylation pathway Ca. 30–50%. (3) A high PO_2 concentration reduces the synthesis of phosphatidylcholine at least at the level of (CH_3-^{14}C) choline incorporation.

6

STUDIES ON FATTY ACID SYNTHESIS IN RAT TESTIS. A. RICHARD WHORTON and JOHN G. CONIGLIO, Dept. of Biochemistry, Vanderbilt University School of Medicine, Nashville, Tenn. 37232.

Synthesis of saturated and unsaturated fatty acids is being studied in rat testis, both in vivo and in vitro. Microsomes from rat testis produced ca. 0.03 nmol of ^{14}C-18:1/min/mg protein when incubated with ^{14}C-stearate for 1 hr under aerobic conditions. The corresponding figure for liver was 0.39. Two hours after the intratesticular injection of ^{14}C-stearate, the injected testis contained an amount of ^{14}C-18:1 to indicate production of ca. 0.015 nmol of 18:1/min/mg microsomal protein. Most of the incorporated ^{14}C-stearate was in phosphatide and free fatty acid pools. Experimental conditions for measuring fatty acid synthetase in soluble fractions from homogenates of testis and liver have been established in order to study the effect of fat deficiency on the synthetase from testis compared to that from liver. Preliminary results suggest that, while the activity of the liver synthetase does increase, that of the testis has not changed markedly after 10 weeks on the fat-free diet.

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PERIPHERAL NERVE MYELIN IN EXPERIMENTAL DIABETES AND IN AGING. H. SINGH, N. SPRITZ and B. GEYER, New York University School of Medicine and Lipid Metabolism Lab., Dept. of Medicine, V.A. Hospital, 408 First Ave., New York, N.Y. 10010.

Abnormalities in Schwann cell function related to the maintenance of myelinization may play an important role in peripheral neuropathy in diabetic patients. We have quantified the amount of myelin in sciatic nerves of rats and rabbits with experimental diabetes, and have measured in vitro their incorporation of isotopic precursers into myelin lipids and protein. Sciatic nerves were incubated with either tritiated water or 1-^{14}-acetate and myelin isolated from the homogenate. Incorporation into myelin phospholipid had first order kinetics, and myelin isolation was quantitative and uncontaminated. In rats with diabetes of 1 week, incorporation was like that of controls. In four groups of four–six diabetic rats with diabetes of 3–12 weeks duration, specific activity ranged from 55 to 71% of controls for phosphotidylcholine—the main constituent and phosphotidylethanolaine and phosphotidylserine—and other phospholipids mith significant incorporation. In 4-month-old rabbits, specific activities of lipids were significantly lower in diabetic animals. In older animals incorporation were about one-third that of the rat and were not different between diabetics and controls. Specific activity of proteins from nerves incubated with 1-^{14}C-leucine in four groups of rats with diabetes of 3–6 one-half weeks duration ranged from 30–50% of controls. Composition of isolated myelin did not differ between diabetics and controls in either species. In the rabbit, however, myelin content decreased in controls with age (1.80 mg/cm of nerve 6, 1.54 at 7, 0.9 at 8 and 0.85 at 10 months of age). In age-matched diabetic rabbits (3–8 months duration) myelin content ranged from 65 to 90% of controls. These studies indicate that defective myelin synthesis in the rat and decreased myelin content in older rabbits occur in experimental diabetes. This suggests that, at least in part, neuropathy in diabetic man may be a consequence of insulin deficiency per se and that experimental diabetes provides a model for its study.

8

EFFECT OF STERCULIC ACID ON AFLATOXICOSIS IN RATS FED DIETS CONTAINING SATURATED OR UNSATURATED FAT. PENELOPE WELLS, LILLA AFTERGOOD and ROSLYN ALFIN-SLATER, UCLA School of Public Health, 405 Hilgard Ave., Los Angeles, Calif. 90024.

Investigations on trout have shown that the cyclopropenoid fatty acids, which occur naturally in small amounts in cottonseed, are powerful cocarcinogens when fed in conjunction with aflatoxin. Attempts to document these findings in mammals, i.e., rats, have been inconclusive. Earlier work in this laboratory has indicated that among rats fed fat-free diets sterculic acid acts synergistically with aflatoxin in suppressing growth and producing pathological changes in both livers and kidneys. In addition it was observed that aflatoxin-induced elevation of oleic acid concentration in liver triglycerides was nullified when sterculic acid was also included in the diets. In this study the effects of sterculic acid and aflatoxin on lipid metabolism and tumor formation were examined when the basal diets contained either saturated or unsaturated fat. Male weanling rats were placed on either saturated or unsaturated fat-containing basal diets to which the following additions were made: (a) basal diet (no supplements); (b) 1.7 ppm aflatoxin B_1; (c) 200 ppm sterculic acid; (d) 1.7 ppm aflatoxin B_1 and 200 ppm sterculic acid. The rats consumed these diets for 3 months and were thereafter maintained on the unsupplemented basal diet (a) until sacrifice at 1 year. Growth was inhibited in rats fed diet (d) (aflatoxin and sterculic acid) but no synergistic inhibition was observed, regardless of the fat source. Liver weights were doubled in response to aflatoxin. When the diet contained saturated fat, sterculic acid had no effect on this response; when the diet contained unsaturated fat, however, sterculic acid in combination with aflatoxin elicited a four-fold increase in liver weight. This increased liver weight reflected the somewhat more severe liver pathology observed in these rats. In the animals fed the saturated fat diet, aflatoxin administration resulted in marked increases in plasmal cholesterol levels. Among animals fed unsaturated fat diets, aflatoxin elicited a slight increase in plasma cholesterol, which was counteracted by the presence of sterculic acid in the diet. Changes were also observed in fatty acid composition of both liver and tumor lipids.

9

APPLICATION OF NMR SPECTROSCOPY FOR DETERMINATION OF TRIGLYCERIDE CONTENT IN MARINE WAX-ESTER OILS. P.J. KE, R.G. ACKMAN and D. HOOPER, Fisheries Research Board, Halifax Lab., P.O. Box 429, Halifax, N.S., Canada.

A study has been made of the NMR spectra of the model wax esters and triglycerides, and some marine wax-ester oils. The proton signals are recorded for such characteristic groups as the olefinic proton and the methine proton in glyceryl, the methylene proton in glyceryl and fatty alcohol attached to carboxyl, the terminal methyl proton, and the remaining protons. Four sets of signals have been accurately integrated for the determination of the content of triglyceride in wax-ester oils. From this determination, quantitative calculation of the average molecular weight and iodine value in marine wax-ester oil are shown to be feasible.

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STRUCTURE ANALYSIS OF α-BRANCHED CHAIN FATTY ACIDS BY GAS CHROMATOGRAPHY AND MASS SPECTROSCOPY. T.A. FOGLIA, P.A. BARR and I. SCHMELTZ, Eastern Regional Research Center, ARS, USDA, 600 E. Mermaid Lane, Philadelphia, Pa. 19118.

The structures of α-branched chain fatty carboxylic acids, prepared during the course of previous studies, have been determined by the combined use of GLC and mass spectrometry as applied to the methyl esters. The branched acid mixtures were shown to contain both monosubstituted (dialkylacetic acids) and disubstituted (trialkylacetic acids) moieties. In general the relative GLC retention times of the alkylsubstituted fatty methyl esters were shorter than the straight chain isomers. It was also noted that for isomeric acids the larger the degree of substitution, the shorter the retention time of the methyl ester. Determination of the exact location of the carbomethoxy group on the hydrocarbon chain was made from an analysis of the mass spectral fragmentation ions. The spectra of the branched fatty carboxylic esters are characterized by the prominence of the McLafferty rearrangement ion. The analysis allows for the differentiation of isomeric dialkyl and trialkylacetic acids, since the former give prominent molecular ions while the latter have prominent M^+-59 ions. The method has been successfully applied to the analysis of complex mixtures of highly branched fatty acids obtained by the carboxylation of alkenes via the Koch reaction or a hydroformylation procedure.

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QUANTITATIVE MEASUREMENT OF CLING OF HOUSEHOLD PLASTIC WRAPS. LYLE HENDRICKSON and HENRY D. CROSS, III, Colgate-Palmolive Co., R&D Dept., 909 River Rd., Piscataway, N.J. 08854.

Throughout the world, various types of plastic films are marketed for household consumer use as a cover for foodstuffs in glass bowls, etc. Critical for acceptable use of these products is the ability of the film to adhere to the external walls of the container. This adhesion of the film to the container is referred to as "cling" by the consumer and by those in the profession. A critical parameter in the development of new household plastic films is the measurement of the cling of the film to various substrates. This has previously been accomplished by various qualitative techniques that can only distinguish between large differences in cling. This paper summarizes the successful development of a quantitative procedure for measuring cling and correlates the quantitative values obtained with consumer preference studies.

12

ANALYSIS AND MONITORING OF *trans*-ISOMERIZATION BY ATR SPECTROPHOTOMETRY. H.J. DUTTON, Northern Regional Research Lab., 1815 N. University, Peoria, Ill. 61604.

Attenuated total reflectance (ATR) for IR determination of *trans*-isomers in fats appears to have distinct advantages over procedures currently used. The standard AOCS method (Cd 14-61 in *AOCS Official and Tentative Methods*) requires weighing and quantitative dilution with carbon disulfide before spectrophotometric analysis at 10.3 μ. In contrast, according to the ATR analytical procedure, one neither weighs nor dilutes but merely fills the cell with oil and reads at 10.3 μ. In addition to analyses for *trans*-isomers in liquid oils, margarines and shortenings, ATR enables one to monitor *trans* development continuously during hydrogenation. The presence of catalyst in unfiltered hydrogenated oils does not interfere with ATR measurements, in contrast to classical transmission measurements. Unfiltered oil from the hydrogenator can be circulated through the ATR cell to record *trans*-isomerization during the reaction.

13

CHROMATOGRAPHIC SEPARATION AND IDENTIFICATION OF NYLON-9 INTERMEDIATES DERIVED FROM SOYBEAN OIL. W.L. KOHLHASE, W.E. NEFF, R.A. AWL, E.H. PRYDE and J.C. COWAN, Northern Regional Research Lab., 1815 N. University, Peoria, Ill. 61604.

Various chromatographic techniques were used in the analysis and preparative separations of reaction mixtures containing 9-aminononanoic acid (ANAC) and related compounds derived from soybean oil. The good water solubility of the products of primary interest made ion-exchange a practical method for their purification. A carboxylic acid-type resin in both the free acid and ammonium forms, a polyamine resin and a quaternary ammonium hydroxide-type resin, or combinations of these, were utilized in various sequences to separate the following compounds from one another: ANAC, 9-aminononanamide (ANAM), 9-hydroxynonanamide, 9-hydroxynonanoic acid, azelaic acid, glycerol and ammonium acetate (ammonolysis catalyst). GLC of either the trifluoracetylated or trimethylsilylated derivatives of these mixtures was carried out with a 20% polyamide resin or a 4% methyl silicone fluid coating on a neutral diatomaceous earth support. TLC on either microcrystalline cellulose or silica gel gave good separations when the developing solvent was aqueous butanol containing a small amount of acetic acid to prevent tailing. The combination of $(NH_4)_2SO_4$ and 2,3-dichloro-1,4-naphthoquinone was an excellent universal reagent for visualization of the spots developed from the variety of compounds tested. Bromcresol green indicator instantly visualized primary, secondary and tertiary amines; ninhydrin generally revealed only the primary amines. Comparative R_f data were obtained on ANAC and several homologous ω-amino acids, and pH effects were noted on the R_f of amino acids—presumably due to several alternate ionic species.

14

ETHYLENE AND DIMETHYL ACETALS FROM HYDROFORMYLATED LINSEED, SOYBEAN AND SAFFLOWER METHYL ESTERS AS PLASTICIZERS FOR PVC. R.A. AWL, E.N. FRANKEL, G.R. RISER and E.H. PRYDE, Northern Regional Research Lab., 1815 N. University, Peoria, Ill. 61604.

Mixtures of mono-, di- and triformyl esters, prepared by selective hydroformylation of linseed, soybean and safflower methyl esters with rhodium and triphenylphosphine catalyst, were acetylated with either methanol or ethylene glycol. Distillation of these acetals gave clear, colorless fractions, characterized chromatographically and spectroscopically as complex isomeric mixtures of di- and triacetal esters. Although the triacetal esters showed excellent compatibility and permanence as primary plasticizers for polyvinyl chloride (PVC), they did not improve its low-temperature properties. The monoacetal esters were compatible as secondary plasticizers but not as primary plasticizers, and did improve the low-temperature flexibility of PVC. Permanence properties were intermediate between those of the di-2-ethylhexyl phthalate control and of the low-temperature control di-2-ethylhexyl sebacate. The diacetal esters exhibited properties intermediate between the tri- and the monoacetal esters. With the standard formulation used, tensile strength, elongation and modulus values from all acetal samples were similar to those values from the phthalate control, but their heat stability was lower. Changes in formulation might improve this property.

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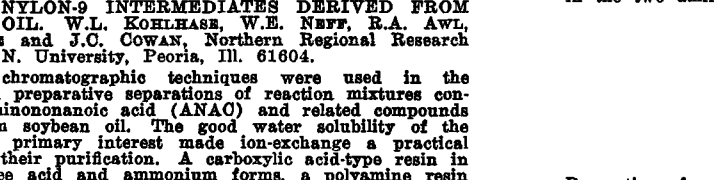
9(10)-CARBOXYOCTADECYLAMINE AND 9(10)-AMINOMETHYLOCTADECANOIC ACID. SYNTHESIS AND POLYMERIZATION TO POLYAMIDES WITH LATERAL SUBSTITUTION. W.R. MILLER, W.E. NEFF, E.N. FRANKEL and E.H. PRYDE, Northern Regional Research Lab., 1815 N. University, Peoria, Ill. 61604.

Availability of 9(10)-formylstearic acid (I) and its derivatives from the selective hydroformylation of oleic acid has made it possible to prepare two C-19 amino acils and polyamides. 9(10)-Formylstearonitrile obtained from oleonitrile was oxidized to the corresponding carboxylic acid. Reduction with Raney nickel catalyst gave 9(10)-carboxyoctadecylamine (II) in good yield and purity. Reductive alkylation of ammonia with I gave the isomeric 9(10)-aminomethyloctadecanoic acid (III). Polymerization of II at ca. 260 C for 6 hr gave clear, hard, somewhat brittle polyamides. Under similar conditions, III gave soft, rubbery polymers that flowed at room temperature. These differences are related to the different substituent locations in the two amino acids:



Properties of copolymers of II with III reflected properties of the major component monomer, although III exercised a disproportionate softening effect. The same was generally true of properties of copolymers of II or III with caprolactam, nylon-66 salt or 9-aminononanoic acid. However copolymers of II with 10–25 mol % of nylon-66 salt were transparent and elastic, and could be drawn into fibers.

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NONCRYSTALLINE POLYAMIDES AND COPOLYAMIDES FROM 9(10)-CARBOXYSTEARIC ACID. W.L. KOHLHASE, E.N. FRANKEL, E.H. PRYDE and J.C. COWAN, Northern Regional Research Lab., 1815 N. University, Peoria, Ill. 61604.

9(10)-Carboxystearic acid (CSA) is available either from rhodium-catalyzed hydroformylation of oleic acid with subsequent air-oxidation or by direct hydrocarboxylation with a palladium catalyst. Although the conversion rate of the internal functional group in CSA and its esters is much lower than that of the terminal group in conventional reactions, polyamides were readily prepared with aliphatic diamines by conventional melt polymerization techniques. These polymers are of potential industrial interest as adhesives and resin modifiers. The polyamides and copolyamides prepared from CSA or its monoester were clear, ethanol-soluble, glassy resins, except for those with high levels of adipic acid comonomer. The temperature of visible flow was markedly affected by CSA purity and by the type and proportion of α,ω-diacid comonomer. Flow temperature of the hexamethylenediamine-CSA homopolyamide (6,b-19 nylon, density 0.96 g/cc) from 99.5% pure CSA was 180 C, but that from 95.8% pure material was 105 C; adding ca. 12 mol % adipic acid to the 95.8% CSA produced a copolyamide with a 180 C flow temperature. To achieve the 160 C flow temperature required for major hot-melt adhesive applications, ca. 24% adipic had to be added to 95.8% CSA and 21% to the 99.5% material. The effects of CSA purity, type of diamine, type and level of symmetrical diacid comonomer and monofunctional and trifunctional carboxylic modifiers on polymer properties will be discussed.

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FAT IN TODAY'S FOOD SUPPLY—LEVEL OF USE AND SOURCES. ROBERT L. RIZEK, BERTA FRIEND and LOUISE PAGE, ARS, USDA, Consumer and Food Economics Institute, Rm. 323, Center Bldg. 1, Hyattsville, Md. 20782.

Nutrient fat—fat from meat, milk, and other fat-containing foods as well as from food fats and oils—in the U.S. food supply has increased ca. 25% over the past 60 years or so, on a per person per day basis. About two-fifths of the fat currently comes from fats and oils, including butter; over a third comes from meat (including fat pork cuts), poultry and fish; and about one-eighth comes from dairy products. This large increase in nutrient fat is due mainly to the use of more vegetable fats—margarine, shortening, and salad and cooking oils. The per capita amount provided by animal fats has actually decreased, because the large decrease in consumption of butter and lard are only partly offset by increases in fat associated with greater consumption of meats. Despite the

decrease in consumption of animal fats, they continue to provide ca. 25% of the total calories. Although the proportion of calories from vegetable fats has increased, animal products still account for the largest share of the calories provided by fat. Shifts in sources of fat and the increased amount of fat have changed the fatty acid content of the food supply.

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ROLE OF LIPIDS IN HEALTH AND DISEASE. RICHARD J. JONES, University of Chicago, Div. of Biological Sciences & Pritzker School of Medicine, 950 E. 59th, Chicago, Ill. 60637.

With the current emphasis on the control of serum cholesterol by a fat-modified diet, it has become all the more necessary to consider the requirement for fat and related compounds in the diet. Fat is an important dietary component by virtue of it's high fuel value, its high palatability, its content of essential fatty acids and its association with fat soluble vitamins. While the fat soluble animal sterol, cholesterol, is thought to be an important irritant stimulating the arterial cell to an atherogenic response, its equivalent in the plant world, sitosterol, is poorly absorbed by the human mucosa and, to the degree that it is ingested, probably impairs absorption of cholesterol. Appropriate dietary efforts to reduce blood cholesterol levels involve a low animal fat diet, with increased carbohydrate intake or increased intake of vegetable oils high in the essential polyunsaturated fatty acids. The importance of reducing the blood cholesterol must be balanced against any possible risks of too little fat in the diet, such as might impose a deficiency of essential fatty acids or fat soluble vitamins, or of too much of the polyunsaturated fatty acids or carbohydrate in the encaloric diet. The current thinking about the importance of dietary fat in the management of diabetes mellitus, peptic ulcer, and the malabsorption syndrome will also be considered.

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CURRENT STUDIES ON RELATION OF FAT TO HEALTH. F.A. KUMMEROW, Burnsides Research Lab., University of Illinois, Urbana, Ill. 61801.

Dietary fats are recognized as a source of economical calories. However their level of intake, and two parameters (the level of cholesterol and the level of polyunsaturated fatty acids in dietary animal and vegetable fats) are believed to be important to health. An excessive intake of dietary sources of saturated fats and cholesterol is believed to represent a "risk factor" in the development of atherosclerosis, the cause of 90% of all heart disease and cerebral strokes. This "risk factor" is believed to be counteracted by an increased intake of polyunsaturated fatty acids and a decreased intake of cholesterol containing foods such as meat, milk and eggs. Whether the level and type of dietary fat is important to the development of degenerative diseases such as heart disease, strokes, cancer, cirrhosis of the liver, kidney damage, muscle dystrophy or neurological diseases is under study in laboratories on all five continents. In the U.S., federal agencies such as the NIH have attempted to shift research interests in the biochemical field to "mission-oriented" research by encouraging the establishment of "centers of excellence" for the study of these degenerative diseases with the hope of enhancing a "cure" for them. The fat and oil industry should be aware of such a trend in research "speed-up," as its economic well being may be influenced by such shifts in research funding. The impact of funding on the rate of research "findings" should be of concern to the fat and oil industry. It should realize that solutions to basic problems are necessary to an understanding of the biochemical events that result in the development of a degenerative disease. Examples of how these needs are not being fully exploited will be presented.

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POSSIBLE EFFECT OF LABELING REGULATIONS ON FAT IN THE DIET. JERRY PROCTOR, Krafteo Corp., R&D, Glenview, Ill.

Abstract not available at press time.

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MODIFICATION OF FOOD TO CONTROL FAT CONTENT. V.K. BABAYAN, Stokely-Van Camp, Inc., 6815 E. 34th, Indianapolis, Ind. 46226.

The amount and type of fat in our food supply has been a dilemma, not only to the public, but to the medical and nutritional society as well. Various methods by which the fat can be controlled range from type of animals selected, the feeding and breeding, to the removal of fat during processing. Modifications of fat, as well as tailor-made fats, are alternatives to consider in the types and levels of fat that should be provided to the consuming public. Changes and modifications in fats, which may occur due to processing and storage, are also considered in view of our interest in nutrition and the nature of our national distribution and marketing practices.

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DDT ABSORPTION AND LIPOPROTEIN TRANSPORT IN THE RAT. DOROTHY M.E. POCOCK and ALAN VOST, University Medical Clinic, Montreal General Hospital, 1650 Cedar Ave., Montreal 109, Queb., Canada.

Male rats with cannulated thoracic ducts were fed 0.1 μmol 14C-DDT in sunflower seed oil by gastric tube. Recovery of 14C-DDT in lymph was 60% in 12 hr. More than 97% of the lymph 14C-DDT occurred in lipoproteins with a density less than 1.006, designated chylomicrons (chylomicrons plus very low density lipoproteins). Mechanical separation of chylomicron polar "coat" (labeled with 32P-phospholipids) from chylomicron triglyceride "core" showed that 97% of the 14C-DDT was present in the triglyceride core and only 3% in the polar coat. Rats with two indwelling in catheters were pulse-injected with chylomicrons that had been simultaneously labeled with 3H-triglyceride and 14C-DDT, and the radioactivity of both isotopes in sequential serum samples was determined. Serum decay of 14C-DDT was very rapid, with an initial half-life of 2 min, and was independent of 3H-triglyceride decay (T ½ = 10 min). When tissues were analyzed 15 min after the injection of 14C-DDT-labeled chylomicrons, 80% of the recovered 14C-DDT was found in liver but only 5% in adipose tissue. However, in hepatectomized (eviscerated) rats, the decay of serum 14C-DDT (T ½ = 13 min) was also independent of and more rapid than 3H-triglyceride decay. In these experiments, DDT was transported from intestine largely in the triglyceride phase of chylomicrons and the disappearance of chylomicron-DDT from the systemic circulation was rapid and independent of the presence of the liver and of triglyceride hydrolysis. Experiments using sucrose density gradients showed that chylomicron 14C-DDT transferred to higher density serum proteins in vivo and to bovine albumin in vitro. In vivo, 14C-DDT in the higher density fraction had a shorter T ½ than 14C-DDT in the chylomicron fraction. These results suggest that DDT may be transported from serum chylomicrons to albumin before tissue uptake.

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WAX ESTERS IN FISH: METABOLISM OF DIETARY WAX ESTERS IN THE GOURAMI. D.M. SAND, C. RAHN and H. SCHLENK, University of Minnesota, The Hormel Institute, 801 16th Ave. N.E., Austin, Minn. 55912.

Earlier experiments with dietary fatty acids and alcohols are supplemented now by feeding dual-labeled wax ester [1-^{14}C]16:0-[9,10-^{3}H] 16:0, to female gouramis (*Trichogaster cosby*). The following major reactions take place when this wax ester is absorbed and metabolized: (a) hydrolysis and resynthesis of wax ester; (b) oxidation of alcohol to acid; (c) reduction of acid to alcohol followed by synthesis of new wax esters. Reactions (a) and (b) occur mainly in the intestinal tissue. The extent to which these reactions take place is subject to the dietary amount and is reflected also in the composition of the blood lipids. The latter can contain wax esters but not free alcohols. Reactions (c) take place in the roe. Large amounts of wax esters are found there, and their analysis shows that both ^{14}C and ^{3}H were more than five times higher in C$_{34}$ than in C$_{32}$ species. About 1% of the radioactivities was found in the original form, [1-^{14}C] 16:0-[9,10-^{3}H]16:0. Both ^{14}C and ^{3}H were in the alcohol moiety at levels more than 10 times higher than in the acid moiety. This distribution in the 16:0 moieties of wax esters is similar to that reached from labeled dietary 16:0 acid or alcohol. The hydrolysis and synthesis of ester and the oxidation of alcohol in the intestinal tissue make the metabolism of dietary wax esters very similar to that of dietary alcohol.

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WAX ESTERS IN FISH: OXIDATION OF FATTY ALCOHOL TO ALDEHYDE AND ACID IN GOURAMI CAECA HOMOGENATES. D.M. SAND, T.W. GRIFFITH and H. SCHLENK, University of Minnesota, The Hormel Institute, 801 16th Ave. N.E., Austin, Minn. 55912.

The efficient oxidation of fatty alcohols to acids by gouramis led to experiments with homogenates of intestines and of caeca. The latter had a three-fold higher oxidizing activity per unit of protein than the former. NAD or NADP were required co-factors, but they did not have additive effect when incubated together. Addition of ATP, CoA and MB++ did not enhance oxidation, but channeled resulting fatty acid into acyl lipids. Caeca preparations at pH 8.0 with NAD as cofactor oxidized 1-^{14}C palmityl alcohol to acid at the rate of 10 nmol/min/mg protein. Under modified incubation conditions palmityl aldehyde was detected with AHMT (4-amino-3-hydrazino-5-mercapto-1,2,4-triazole) among the products of oxidation. The amount of aldehyde formed depends on several factors.

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WAX ESTERS IN FISH: REDUCTION OF FATTY ACIDS AND FORMATION OF WAX ESTERS IN GOURAMI ROE HOMOGENATES. T.W. GRIFFITH, D.M. SAND and H. SCHLENK, University of Minnesota, The Hormel Institute, 801 16th Ave. N.E., Austin, Minn. 55912.

The existence of in vivo reduction of fatty acids and esterification of fatty acids and alcohols in gourami roe has been substantiated in roe homogenates. Reduction of fatty acid to alcohol requires the presence of ATP, CoA and NADPH. NADH does not substitute for NADPH. The reducing activity is located mainly in the 100,000 *g* particulate fraction and has an optimum near pH 6.5. High substrate concentrations inhibit the reduction. Aldehyde is detected and appears to remain at a constant level until the substrate acid is depleted. The amount of aldehyde is higher with 18:1 than with 16:0 acid as substrate, and the reduction of 18:1 acid to alcohol is slower than that of 16:0 acid. This specificity of the reducing enzyme for chain structure reflects the natural roe wax composition where the level of 16:0 alcohol is higher than that of 18:1 alcohol. The esterification activity has a pH optimum near 8. Esterification of labeled fatty alcohol to form wax esters requires no cofactors but can be stimulated by ATP and CoA. Esterification of labeled fatty acids to form wax ester requires the presence of ATP and CoA. A complete roe homogenate with 18:1 acid and all cofactors added yielded ratios of 18:1 alcohol to acid in the wax esters similar to those found for 18:1 moieties in the natural roe wax esters. The same trend was found from 16:0 acid as substrate.

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RAPID DETERMINATION OF PROTEIN IN SOYBEAN MEALS BY PLANT OPERATORS. FRANK J. PEASE, A. E. Staley Manufacturing Co., Bldg. 60, 2200 Eldorado St., Decatur, Ill. 62525.

This paper discusses the utilization of a DICKEY-john Grain Analyzer for protein control in a commercial soybean plant. The control of protein in soybean meal in a commercial operation is normally done by inference because of the time required to determine protein by the Kjeldahl method. A protein result can be obtained in less than 5 min utilizing a DICKEY-john Grain Analysis Computer. This analyzer can be located in the plant and operated by plant operators with a minimum amount of training. It utilizes an optical-electrical principle developed by the USDA in Beltsville, Md. The DICKEY-john Analyzer is initially calibrated against the standard Kjeldahl method. A statistical analyses of the data compares the accuracy and precision of the two methods.

27

EVALUATION OF METTLER AUTOMATIC DROPPING POINT APPARATUS AND STATISTICAL COMPARISON WITH WILEY MELTING POINT METHOD. W.G. DOEDEN, Swift & Co., R&D Center, 1919 Swift Dr., Oak Brook, Ill. 60152.

The Mettler FP5/53 automatic thermal analysis system was used to obtain dropping point data on a series of soybean, cottonseed, palm and rapeseed oils after conditioning for 30 min at freezer temperature. Wiley melting points were simul-

taneously determined on the same samples. A linear correlation was observed between the dropping point and Wiley melting point data over a temperature range of 33–50 C. Meaningful data were also obtained on various fat blends and on samples outside this temperature range. The dropping point technique was found to be more reproducible and less time consuming than the Wiley method, while offering the added advantage of automatic endpoint detection. This technique has been used successfully in our laboratories for quality control and as a means of monitoring hydrogenation studies. Although the dropping point method can be related to the Wiley melting point determination, it has developed into a meaningful independent measure of the melting characteristics of fats and oils.

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INFLUENCE OF CARBOXYL GROUP SUBSTITUENTS UPON MASS SPECTRA OF UNSATURATED FATTY ACID MOIETIES. BENGT Å. ANDERSSON and RALPH T. HOLMAN, The Hormel Institute, University of Minnesota, 801 16th Ave. N.E., Austin, Minn. 55912.

Mass spectrometric fragmentation patterns of unsaturated straight chain fatty acids are influenced by the nature of the carboxyl group substituent. Some carboxyl group derivatives have been found to exert a charge-retaining and stabilizing effect upon the hydrocarbon moiety of the fatty acid under electron impact. Such derivatives give very simple mass spectrometric cleavage patterns from which the double bond positions can be deduced directly from the spectra. In contast to the commonly used derivativization of the double bond, appropriate modification of the carboxyl group has advantages of speed, simplicity and applicability to polyunsaturated acids.

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BUNSEN COEFFICIENT FOR OXYGEN IN MARINE OILS AT VARIOUS TEMPERATURE DETERMINED BY AN EXPONENTIAL DILUTION METHOD WITH A POLAROGRAPHIC OXYGEN ELECTRODE. P.J. KE and R.G. ACKMAN, Fisheries Research Board, Halifax Lab., P.O. Box 429, Halifax, N.S., Canada.

A polarographic oxygen electrode has been applied to an exponential dilution method for the determination of the solubility of oxygen in oils. Results are compared with other chemical and physical methods for herring and olive oils and the same oils subjected to partial oxidation. The Bunsen coefficients for oxygen in nine marine oils have been determined by this procedure 20 to 80 C. The densities and viscosities of these oils have been measured for the same temperature range. In general, the Bunsen coefficient for oxygen in marine oils increases with an increase in temperature between 20 to 60 C, but then rapidly decreases between 60 and 80 C to a value lower than that for room temperature. It appears that autoxidation should not be the major cause of this effect, as the measurement rate was relatively rapid. Some tentative correlations between the solubility of oxygen in marine oils and the *fatty acid composition, iodine value, density* and viscosity are discussed briefly.

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THERMAL PROPERTIES OF PLASTIC SOLIDS OBTAINED BY TALLOW FRACTIONATION. J.W. HAMPSON, F.E. LUDDY, S.F. HERB and H.L. ROTHBART, Eastern Regional Research Center, ARS, USDA, 600 E. Mermaid Lane, Philadelphia, Pa. 19118.

Research on tallow fractionation at ERRC has produced a plastic solid that is being considered as a replacement for cocoa butter or confectionery hard butters. The thermal properties (melting profiles, tempering studies and solid-fat index) of various plastic solids, made by different fractionation schemes, were studied by differential scanning calorimetry (DSC). The DSC data for several fractions compare favorably with data obtained on cocoa butter and several commercial hard butters. In addition, *desired thermal properties* are obtained by blending various tallow fractions. The compatibility of these and other tallow fractions with cocoa butter is demonstrated. The thermomechanical properties (penetration and expansion) of the plastic solid and cocoa butter were compared using 10 mg samples.

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PULSE NMR—HIGHLY AUTOMATED METHOD FOR DETERMINING SOLID FAT CONTENT IN PARTIALLY CRYSTALLIZED FATS. K. VAN PUTTE and J.C. VAN DEN ENDEN, Unilever Research Vlaardingen, P.O. Box 114, Vlaardingen, The Netherlands.

NMR has proved to be a good alternative for the slow and laborious dilatometer technique used to determine the solid fat content in partially crystallized fats. In this paper, the development of pulse NMR into a quick and accurate determination method is described. The method is fully automated; 6 sec after placing the sample into the sample holder, the percentage of solids is displayed on a digital voltmeter or printed out. The standard deviation is 0.3% solids and almost independent of the percentage present. To allow for the dead time of the receiver a correction factor is introduced, but this gives rise to only small errors (<1%) in the solid fat content. Due to the short measuring time, no temperature control of the sample holder is required between 10 and 45 C. This increases the flexibility of the spectrometer considerably, because no time is lost in switching over to other measuring temperatures.

31A

DETERMINATION OF EMULSION STABILITY BY MICROWAVE HEATING. GARY E. PETROWSKI, Carnation Research Labs., 8015 Van Nuys Blvd., Van Nuys, Calif.

Abstract not available at press time.

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DECARBONYLATION OF UNSATURATED ACID CHLORIDES. P.A. BARR, T.A. FOGLIA and I. SCHMELTZ, Eastern Regional Research Center, ARS, USDA, 600 E. Mermaid Lane, Philadelphia, Pa. 19118.

The decarbonylation of linear unsaturated carboxylic acid chlorides, e.g., oleoyl chloride, into mixtures of diene hydrocarbons having one less carbon atom than the starting acid chloride was investigated. Transition metal catalytic systems ($PdCl_2$, $RhCl_3$) were employed for the decarbonylation of oleoyl chloride. The choice of catalyst, other parameters remaining constant, determined the composition of the diene mixture. One catalyst gave a mixture of highly conjugated diene and a skipped diene. With another catalyst only skipped diene was formed. Characterization of the diene mixtures was made on the basis of spectrophotometric methods and ozonolysis studies. Hydroformylation of the highly conjugated diene mixture followed by oxidation of the formyl product resulted in a predominately mono carboxylic acid product, whereas dicarboxylic acids were the major products obtained from the hydroformylation-oxidation of the nonconjugated diene mixture. Product identification of these acids was made on the basis of gas chromatographic and spectroscopic evidence. Characteristic properties of the acids, i.e., saponification number, acid number, iodine number, were determined and correlated with the structural features of the acids.

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STUDY OF COLOR STABILITY OF TALL OIL FATTY ACIDS THROUGH ISOLATION AND CHARACTERIZATION OF MINOR CONSTITUENTS. DAVID B.S. MIN and STEPHEN S. CHANG, *Dept. of Food Science, Rutgers, The State University*, P.O. Box 231, New Brunswick, N.J. 08903.

High quality tall oil fatty acids (unsaponifiables 1.5% maximum, rosin acids 1.5% maximum) have a tendency to develop a dark color during heating. The present investigation found that the development of the dark color during heating *was partially due to the presence of minor constituents.* They were isolated and separated into numerous fractions by low temperature solvent crystallization and repeated liquid column chromatography. The fractions, which caused darkening of purified tall oil fatty acids during heating, were characterized by functional group analyses, chemical reactions, and UV and IR spectrophotometric analyses. The results indicated that they were oxidized fatty acid derivatives, rich in oxygen content. The effect of these minor constituents upon the color stability of purified tall oil fatty acids was closely related to the hydroxyl group content of the molecule. Hydrogenation to various degrees indicated that the hydroxyl groups α to the double bond were responsible for the darkening of tall oil fatty acids during heating.

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γ-RADIOLYSIS OF CRYSTALLINE STEARIC ACID. GUEY-SHUANG WU and DAVID R. HOWTON, Lab. of Nuclear Medicine and Radiation Biology, 900 Veteran Ave., Los Angeles, Calif. 90024.

Crystalline stearic acid has been irradiated with ^{60}Co γ-rays (dose: 100 Mrads) at 10 C, and all major nongaseous products have been identified and quantitated. *n*-Heptadecane (G, 2.90), believed formed primarily from cation radicals, is the most abundant *monomeric product.* Stearaldehyde (a type of product hitherto positively identified only in the case of acetic acid) produced in next largest quantity (G, 0.32) and is believed to arise via several reaction pathways. Quantitatively important *dimeric products* are di-*n*-heptadecyl ketone (G, 0.47), α,α'-di-*n*-hexadecyl succinic acid (G, 0.18) and *n*-tetratriacontane (G, 0.06). There is evidence to suggest that both di-*n*-heptadecyl ketone and *n*-tetratriacontane are formed by union of two radicals produced simultaneously from the H-bonded "dimers" of which the crystalline acid consists. The α-linked dehydrodimers (approximately equal amounts of the two possible diastereoisomers) are obtained in quantity considerably less than that expected on the basis of formation via union of α-radicals, RCHCOOH, and such α-radical precursors are not trapped by postirradiation scavenging with iodine.

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PROPERTIES AND UTILITY OF PETROLEUM-DERIVED SECONDARY ALKYL AMINES. J.H. KOLAIAN, T.P. CHEN and M.D. RIORDAN, Texaco Inc., P.O. Box 509, Beacon, N.Y. 12508.

Secondary alkyl primary amines in the fatty range have been prepared from petroleum-derived *n*-paraffins via a nitration-hydrogenation process. The amine functional group is randomly distributed along the linear carbon chain, resulting in distinct property differences such as substantially lower melting points when compared to fatty acid derived amines. Derivatives of these primary amines have also been synthesized. Typical of derivatives prepared are secondary, tertiary and quaternary amines, diamines, amine oxides and various amine salts. Various application areas have been investigated with the *secondary alkyl primary amines and their derivatives.* Evaluations were made for utility in textile finishing and fabric softening, surface alteration of minerals, biocidal applications, petroleum applications such as additives for fuels and lubricants and in oil producing and refining operations. Other surfactant areas were also investigated. The results of these evaluations indicate that the synthetic secondary alkyl amines and derivatives can be utilized in many industrial applications presently served by fatty acid derived amines.

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GRAIN CLEANING AND SCREENING. ALEX C. YOUNG, The Orville Simpson Co., Cincinnati, Ohio.

Abstract not available at press time.

37

GRAIN DRYING. JAMES F. KELLY, Aeroglide Corp., Raleigh, N.C.

Abstract not available at press time.

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DEHULLING. RUSSELL W. KICE, Kice Metal Products Co., Inc., 2040 S. Mead, Wichita, Kans. 67211.

This paper will discuss equipment and problems relating to various positions in the processing system of soybeans where dehulling is assisted or accomplished. Quality dehulling results only when attention is given to each step in the flow from start to finish.

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FLAKING. N. HUNT MOORE, N. Hunt Moore and Associates, Memphis, Tenn.

Abstract not available at press time.

40

EXTRACTION—HISTORY AND TECHNIQUES. WILLIAM A. BARGNE, French Oil Mill Machinery Co., Piqua, Ohio.

Abstract not available at press time.

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DISTILLATION AND SOLVENT RECOVERY. E. MILLIGAN, EMI Corp.

Abstract not available at press time.

42

CONSUMER ADVOCATE'S VIEW OF FOOD ADDITIVES. MICHAEL F. JACOBSON, Center for Science in the Public Interest, 1779 Church St., N.W., Washington, D.C.

In recent years food additives—their use and safety—has been one of the focal points of the growing consumer movement. Public concern has been heightened by government bans of cyclamate, diethyl pyrocarbonate, NDGA, Violet No. 1 and other additives. The public is now well aware that additives can add a hazard to the foods. While deaths and severe injury from additives are rare, more and more attention must be given to long term, difficult-to-detect effects. Eliminating unnecessary additives can eliminate unnecessary risks of birth defects, cancer and mutations. The goal for industry should be to produce high quality food that carries a minimum risk from additives. The industry's and food technologists's concern for quality must extend, of course, to other aspects of food: that it be nutritious, that it be part of a balanced diet, that it be free of adulterants and contaminants. In these matters the long term interests of both industry and the public are identical.

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ECONOMICS OF FOOD ADDITIVES. JOHN ANGELINE, A.D. LITTLE, Cambridge, Mass.

Abstract not available at press time.

44

SAFETY OF EMULSIFIERS USED IN FATS AND OILS. NEIL R. ARTMAN, Procter and Gamble Co.

Consumers have come to expect many foods that can be served with minimum effort. Such convenience foods frequently require the use of emulsifiers in their formulations. Emulsifiers enable fatty and aqueous phases to be combined. Various emulsifiers have been developed to meet specific needs, and have been judged adequately safe for their intended uses. Safety evaluation programs may include both feeding studies and metabolic studies. Feeding studies establish the levels at which a compound can be fed to experimental animals with no detectable ill effects. From this information it is possible to estimate quantities that may safely be consumed by humans. Metabolic studies tell how a compound is handled by the body—whether it is burned for energy, stored or excreted. The choice of studies to use in evaluating a specific compound depends on the chemical nature of the compound, its similarity to familiar materials, and its intended use. Studies carried out with polysorbates and with monoglycerides will be described to illustrate these points and to show how safety testing programs yield the information needed for making sound safety judgments.

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TOXICITY OF EDTA. FRANKLIN A. AHRENS, Dept. of Veterinary, Physiology & Pharmacology, College of Veterinary Medicine, Iowa State University, Ames, Iowa 50010.

Disodium ethylenediaminetetracetic acid (Na_2EDTA) and its calcium chelate (CaEDTA) are among the most widely used sequestrants added to foods. Concentrations ranging from 25 to 500 ppm effectively inactivate trace metal ions adversely affecting color, clarity, stability, flavor and other characteristics of foods primarily through metal-catalyzed enzyme reactions. Gastrointestinal absorption of CaEDTA is poor; ca. 95% of an oral dose is recovered in the feces. The fraction absorbed is distributed in the extracellular fluid space and excreted unchanged in the urine by glomerular filtration. Extensive safety evaluation studies in rats and dogs exposed to dietary CaEDTA at doses of 500–5000 ppm for 1 year (dogs) or 2 years (rats) revealed no toxic effects of the chelate on growth, reproduction, lactation, hematopoiesis, mineral metabolism or longevity. More recent evidence in poultry indicates oral EDTA exacerbates the effects of mineral-deficient diets. Levels of Disodium EDTA or CaEDTA from 800 to 1600 ppm in diets deficient in calcium, iron and manganese depressed growth, hemoglobin and increased the incidence and severity of perosis. Paradoxically, absorption of zinc is increased with low dietary levels of Na_2EDTA (100 ppm) and decreased with high level (30,000 ppm). These high levels are teratogenic in rats. In medicine, CaEDTA is employed in the treatment of certain heavy metal poisonings. Sustained parenteral administration is frequently required to mobilize the metal to subtoxic levels. Although nephrotoxicity was considered the main hazard associated with this therapy, recent studies in experimental animals reveal morphologic and functional lesions in the intestine as well as the kidney. These changes are accompanied by increased degradation of collagen and increased activity of lysosomal enzymes. In contrast to CaEDTA, sustained infusions of chromium EDTA, a very stable chelate, are nontoxic.

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AMNIOTIC FLUID PHOSPHOLIPIDS IN NORMAL, DIABETIC AND DRUG ABUSE HUMAN PREGNANCY. ERIC J. SINGH, FREDERICK P. ZUSPAN and ALFONSO MEJIA, Dept. Obstetrics and Gynecology, University of Chicago, 5841 S. Maryland Ave., Chicago, Ill. 60637.

The concentration, composition and fatty acid components of amniotic fluid phospholipids during gestation and at term in normal, diabetic and drug abuse human pregnancy have been studied. The mean concentration of total phospholipids was significantly higher at term than during the different stages of gestation in normal, diabetic and drug abuse patients. There was also a highly significant increase in the ratio of phosphatidylcholine to sphingomyelin in late human pregnancy. The present results indicate that analysis of amniotic fluid phospholipids may be of clinical interest in determining the fetal maturity. The phospholipid pattern at term was distinctly different from different periods of earlier gestation. The fatty acid composition of the phosphatides may prove to be of diagnostic value in determining the status of fetus. These results will be presented.

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INFLUENCE OF EFA NUTRITION AND CPIB ON TESTICULAR PATHOLOGY AND FATTY ACID CONTENT. IAN J. TINSLEY and ROBERT R. LOWRY, Dept. of Agricultural Chemistry, Oregon State University, Corvallis, Ore. 97331.

An increase in liver size together with proliferation of liver membrane structures could impose an additional demand for essential fatty acid (EFA). Agents such as ethyl *α-p*-chlorophenoxy-isobutyrate (CPIB), which induce such changes, could be expected to influence the distribution of EFA in the animal and as a consequence accentuate the response to an EFA deficiency. Rats were exposed to an EFA deficiency preweaning by transferring the dam to a ration containing 25% hydrogenated coconut oil 3 days after the pups were born. At weaning, half the animals were continued on the deficient ration while the other half received a corn oil supplement. Testicular changes have been studied in both groups of animals as influenced by dietary CPIB (0.2%). The EFA deficiency produced mild atrophy of the germinal epithelium of the testis and the expected changes in fatty acid composition: increased proportions of ω9 PUFA (20:3, 22:3, 22:4) and decreased proportions of ω6 PUFA (18:2, 20:4, 22:5). CPIB produced only minimal changes (pathology and fatty acid composition) in the testes of EFA-supplemented rats. With the EFA-deficient rats CPIB reduced relative testis size (g/100 g body wt), produced marked degeneration of germinal epithelium, and reduced further the proportions of ω6 PUFA in testicular lipids. There appeared to be a relation between the degree of testicular degeneration and the proportion of ω6 PUFA in testicular lipid. These data indicate a pronounced interaction between EFA deficiency and exposure to CPIB.

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SOME PHYSIOLOGIC AND MORPHOLOGIC EFFECTS OF TUNG OIL. J.C. MCPHERSON, JR., M. SHARAWY and T.R. DIRKSEN, Dept. of Surgery, Medical College of Georgia, Augusta, Ga. 30902.

Studies involving the feeding of tung oil to experimental animals have been mainly concerned with its effect on blood cholesterol levels, growth, decreased food intake and the change in its optical absorption maximum during intestinal absorption. We observe that rats fed tung oil via stomach tube developed wet chins after a few days, and the saliva was viscous and ropy (a phenomenon called spinnbarkeit). Rats fed corn oil had none of these findings. Two groups of rats were fed tung or corn oil for 18 weeks, and the viscosity of the pooled saliva from groups of three animals was measured. The saliva of rats fed tung oil was more viscous than saliva from corn oil-fed animals ($p < 0.001$) as measured in Cannon-Ubbelohde semimicro viscometers. Other animals from each group were sacrificed for microscopic examination of the salivary glands. In both the parotid and submaxillary glands, the acinar and granular duct cells of the tung oil-fed animals contained more mucoproteins (PAS positive staining material) than the glands from the corn oil-fed controls. These cells, in the tung oil-fed rats, were hypertrophied and had their nuclei flattened and pushed toward the base of the cell. Other workers have reported in studies on animals fed tung oil that there were no gross or microscopic changes in tissues from the tung oil. The changes observed here are probably a result of more specific staining techniques than previously employed. Tung oil seems to stimulate salivary glands in rats.

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EFFECTS OF EXOGENOUS SATURATED FAT AND CHOLESTEROL WITH OR WITHOUT ESSENTIAL FATTY ACIDS ON ERYTHROCYTE LIPIDS IN DOGS. ANTANAS BUTKUS and L. ALLEN EHRHART, Research Div., Cleveland Clinic Foundation, 9500 Euclid Ave., Cleveland, Ohio 44106.

Thirty-two adult male dogs were placed into four groups of eight dogs each. One group was fed a standard diet of Ken-L-Ration: beef byproduct (5:1) (I). A second group received a semisynthetic diet consisting of 29% sucrose, 20% casein, 16% hydrogenated coconut oil and 5% cholesterol together with 27% nonnutrive bulk and 3% salt and vitamin mixture, which has previously been shown in our laboratory to be atherogenic when fed for a year (II). The third group received II less 5% cholesterol (III), and the fourth received diet II plus 2% safflower oil supplement (IV). All dogs were kept on their respective diets for a year. The increase in plasma lipids had no effect on trythrocyte lipid concentration. Changes in fatty acid distribution were, however, observed especially in the phospholipids of dogs fed the essential fatty acid-deficient, cholesterol-containing diet II. Addition of essential fatty acids to II (IV) appeared to greatly diminish the effects of exogenous cholesterol on erythrocyte fatty acids, since results from animals fed III and IV were very similar. An increased osmotic fragility was noted only with RBC from dogs fed diet II, which likewise was the same group showing the greatest susceptibility to alterations in RBC phospholipid fatty acid distribution. These data suggest that modification of the fatty acid distribution of RBC phospholipids may be responsible for decreased membrane stability.

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NO-PHOSPHATE LIQUID LAUNDRY DETERGENTS: CORRELATION BETWEEN CHEMICAL CONSTITUTION AND DETERGENCY OF ALCOHOL ETHOXYLATES AND ETHOXYSULFATES. J.C. ILLMAN, T.B. ALBIN, W.T. SHEBS, D.W. BISACCHI and H. STUPEL, Shell Development Co., Chemical Research Lab-Katy, P.O. Box 79090, Houston, Tex. 77079.

Four types of commercially available surfactants that can be formulated into heavy duty liquid laundry detergents have been evaluated in Terg-O-Tometer tests. The detergency performance of alcohol sulfates, alcohol ethoxylates and alcohol ethoxysulfates was compared to linear alkylbenzene sulfonate using a no-phosphate formulation. In addition, the alcohol-derived surfactants fere studied to locate optimum ethylene oxide content and molecular weight of the parent alcohol with respect to detergency. Ethylene oxide content was varied from five to twenty ethylene oxide groups per mole of alcohol for ethoxylates and from zero to six ethylene oxide groups for ethoxysulfates. The carbon number of the parent alcohol ranged from C_{10} to C_{15}. In general, a large change in the detergency performance of ethoxysulfates is observed across

the range of carbon number studied, with optimum detergency in the C_{13}–C_{15} range. Ethoxylate performance is less sensitive to carbon number variations. Under the test conditions employed, both ethoxysulfates and ethoxylates appear to be excellent surfactants for no-phosphate heavy duty liquids.

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ROLE OF STABILIZERS IN HEAVY DUTY LIQUID DETERGENTS. R.L. LISS and J.N. HUGGINS, Monsanto Co.

Abstract not available at press time.

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FLUORESCENT WHITENING AGENTS IN HEAVY DUTY LIQUID DETERGENTS. J.I. GERKO, American Cyanamid.

Abstract not available at press time.

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ROLE OF SILICATES IN HEAVY DUTY LIQUID DETERGENTS. D.L. MUCK, Philadelphia, Quartz.

Abstract not available at press time.

54

DESOLVENTIZING TOASTING. R. GOOD, Blaw-Knox Chemical Plants, Inc., Pittsburgh, Pa.

Abstract not available at press time.

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ART OF OILSEED MEAL GRINDING. GEORGE R. THOMAS, Prater Industries, Inc., Cicero, Ill.

Abstract not available at press time.

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DUST COLLECTION. KEN LUCE, Carter Day Co., Minneapolis, Minn.

Abstract not available at press time.

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REVISIONS TO NFPA NO. 36—SOLVENT EXTRACTION PLANTS. JOHN E. HEILMAN, Allied Mills, Inc., Chicago, Ill.

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SAFETY EVALUATION AND BIOCHEMICAL BEHAVIOR OF MONOTERTIARY BUTYL HYDROQUINONE (TBHQ). B.D. ASTILL, C.J. TERHAAR, W.J. KRASAVAGE, G.L. WOLF, R.L. ROUDABUSH, D.W. FASSETT and K.E. MORGAREIDGE, Food and Drug Research Lab., Inc., Health and Safety Lab., Eastman Kodak Co., Kodak Park, Rochester, N.Y. 14650.

The safety of TBHQ as an oil soluble food grade antioxidant was evaluated in acute studies with rats, mice, guinea pigs and dogs, subacute feedings in rats, rat reproductive efficiency and placental transfer studies, and subacute feedings with TBHQ heated in vegetable oil. In lifetime feedings in rats and 2 year feedings in dogs, weight gain, feed consumption, behavior, mortality, hemograms, clinical chemistries (including SGOT, SGPT, SAP, BUN, protein, urinalyses), gross, microscopic and electron microscopy were evaluated. There were no toxic or untoward effects. TBHQ was handled similarly by rats, dogs and humans. Rats eliminated single oral 0.1–0.4 g/kg doses mostly in the urine in 3–4 days as the 4–0-sulfate (57–80%), the 4–0-glucuronide (4%) and with 4–12% unchanged. 2,3,5,6-^{14}C-TBHQ was similarly eliminated with <0.1% as $^{14}CO_2$ and <0.2% remaining in the animal after 4 days. Oral 0.1 g/kg doses to dogs gave a somewhat higher glucuronide contribution. Humans eliminated 0.002 g/kg single doses (high fat vehicle) almost completely in the urine in 2–3 days, with <0.1% unchanged, 73–88% as the 4–0-sulfate and 15–22% as the 0-glucuronide. The elimination pattern was little altered in long term feeding. TBHQ residues (spectrophotofluorometric) in tissues of long term animals were below lower detection limits. TBHQ did not induce liver microsomal mixed function oxidases in short and long term rat and dog feedings. The feeding studies and comparative biochemical studies showed TBHQ to be safe for its intended use.

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BIOCHEMISTRY AND TOXICOLOGY OF BUTYLATED HYDROXYTOLUENE (BHT) AND BUTYLATED HYDROXYANISOLE (BHA). A.L. BRANEN, Department of Food Science, University of Wisconsin, Madison, Wis. 53706.

Butylated hydroxytoluene (BHT) and butylated hydroxyanisole (BHA) are used extensively as food antioxidants. It is estimated that man consumes ca. 0.1 mg/Kg of body weight daily of these antioxidants. Both BHA and BHT appear to be free of any obvious injurious effects when administered to rodents or monkeys at doses of 50 mg/Kg of body weight. At higher doses of 500 mg/Kg/day, BHA and BHT result in an adaptive hypertrophy of the liver resulting in proliferation of smooth endoplasmic reticulum and modification of hepatic microsomal enzymes. These changes have been attributed to increased activity rather than pathological alterations, and occur in both rodents and monkeys. However major differences exist between the responses of rodents and monkeys to these antioxidants. In rodents treatment with BHT results in more pronounced changes than BHA, while in monkeys the opposite is true. BHA and BHT increase serum cholesterol in rodents but decrease serum cholesterol in monkeys and, although brain and behavioral changes are reported to occur in the offspring of rodents fed high levels of BHA and BHT, no such changes occur in monkeys. These differences in response are undoubtedly a result of the reported differences in excretion and metabolism of BHA and BHT by primates and rodents. Early reports indicated teratogenic effects of BHT and carcinogenicity of BHA; however in subsequent experiments these effects were not shown. In fact recent evidence indicates that BHA and BHT can inhibit chemically induced carcinogenesis. These results, as well as possible relationships between BHA and BHT and vitamin E, will be discussed.

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SOME CONSIDERATIONS ON USE AND ABUSE OF VITAMIN A. E.M. BLENDERMANN and J.W. BOEHNE, Nutrition Div./BF-124, FDA, 200 C Street S.W., Washington, D.C. 20204.

There have been some recent indicators of less than desirable levels of intake of vitamin A in segments of the population. These point to both inadequate and excessive intakes, for which unsound food fortification practices may be partly responsible. The ingestion of extremely high levels of vitamin A, either as a therapeutic agent in self-medication or physician-directed treatment, or through uncontrolled fortifications of many foods, may have undesirable effects. This paper will discuss some nutritional and toxicological aspects of vitamin A, with particular emphasis on recent actions taken by the FDA to provide the consumer some degree of protection against the risks involved in too little or too much of this essential nutrient.

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NEW ASPECTS OF VITAMIN D METABOLISM AND FUNCTION. H.F. DELUCA, Dept. of Biochemistry, University of Wisconsin, Madison, Wis. 53706.

Vitamin D_3 must first be hydroxylated on carbon 25 in the liver and subsequently on carbon 1 in the kidney before it can stimulate intestinal calcium transport and bone calcium mobilization. The 25-hydroxylation takes place primarily in microsomes, requires molecular oxygen and NADPH, and is strongly feedback-regulated by 25-hydroxyvitamin D_3 (25-OH-D_3) itself. The regulation is such that the blood level of 25-OH-D_3 is maintained relatively constant in the face of large variations in vitamin D intake. The 1-hydroxylation of 25-OH-D_3 to 1,25-dihydroxyvitamin D_3 (1,25-[OH]$_2$$D_3$) is feedback-regulated indirectly by serum calcium concentration. Low blood calcium results in marked increases in 1,25-(OH)$_2$$D_3$, while normal and high blood calcium results in diminished synthesis of 1,25-(OH)$_2$$D_3$. Another metabolite, 24,25-dihydroxyvitamin D_3 (24,25-[OH]$_2$$D_3$) is formed under normal and hypercalcemic conditions, but its function is unknown at present. Evidence is rapidly accumulating that the parathyroid glands sense the serum calcium and in response to hypocalcemia secrete parathyroid hormone, which in some way triggers synthesis of 1,25-(OH)$_2$$D_3$. Hypophosphatemia induced by dietary means or by glucose infusion also stimulates 1,25-(OH)$_2$$D_3$ synthesis. The molecular mechanisms involved in the regulation are now being investigated. The 1,25-(OH)$_2$$D_3$ acts directly on intestine and bone without further metabolic alteration. In intestine the 1,25-(OH)$_2$$D_3$ is bound to specific receptor proteins, which in some way stimulate calcium absorption. Analogs of 1,25-(OH)$_2$$D_3$ have been synthesized that permit a structure-function study. From these 1α-hydroxyvitamin D_3 has emerged. This analog can substitute completely for 1,25-(OH)$_2$$D_3$. The potential application of this compound and metabolites to the treatment of renal osteodystrophy, vitamin D-resistant rickets and various types of hypoparathyroidism will be discussed.

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VITAMIN E AS A FOOD ADDITIVE. LLOYD A. WITTING, Texas Woman's University, Denton, Tex. 76204.

It is quite well known that vitamin E, R-α-tocopherol, is an extremely poor antioxidant and is of relatively little use in the stabilization of foods containing linoleic acid or more highly unsaturated fatty acids. The free alcohol may be oxidized in the gut and, if addition is for the purpose of nutritional supplementation, the acetate should be used. This form of the vitamin will, of course, have no activity as an antioxidant prior to consumption. Vitamin E is relatively poorly absorbed from the gut and tissue levels increase only in proportion to the logarithm of the dose. Tissue levels of vitamin E attained on a normal mixed diet tend to approximate the optimal level found to be active as an antioxidant in model system studies. In a very few, highly specific stress situations some small benefit may be gained by ingestion of abnormal quantities of vitamin E, but other synthetic lipid antioxidants are usually more active. Aside from its lack of toxicity R-α-tocopherol's major advantage over other lipid antioxidants is in the subcellular distribution pattern and rate of turnover in the tissues. If a strong nontoxic, fat soluble lipid antioxidant were found with a similar distribution and turnover, significant biological benefits might be gained.

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ACETYLENIC FATTY ACIDS IN MOSSES. H. SCHLENK, B.A. ANDERSON, W.H. ANDERSON, J.R. CHIPAULT, E.O. ELLISON, S.W. FENTON, J.L. GELLERMAN and J.M. HAWKINS, University of Minnesota, The Hormel Institute, 801 16th Ave. N.E., Austin, Minn. 55912.

Fatty acids containing a triple bond had been encountered so far only in certain seed plants, but have been detected now also in some mosses. The lipids of *Ceratodon purpureus* contain 20% of an acetylenic acid, which was identified as all-*cis*-9,12,15-octadecatrien-6-ynoic acid. Assignment of this structure is based on analyses for which 95% pure methyl ester of the acid was used. Mass spectrometry showed the molecular weight and straight chain of the molecule and indicated double bonds with an ω3 structure. Ozonization showed the ω3 structure of double bonds and a triple bond in position 6. The UV and IR spectra showed *cis* double bonds, no conjugation and no *trans* double bonds. The Raman spectrum proved the presence of a triple bond, showed no conjugation and indicated, according to model mixtures, a ratio close to one-third for $C \equiv C/C = C$. The 9,12,15-octadecatrien-6-ynoic acid so far has not been described from biological materials. It is accompanied by small amounts of an octadecadien-diynoic acid. Both acids are bound in the triglycerides but not in other lipids of the *Ceratodon* moss. Acetylenic acids occur also in certain other mosses, but in contrast to arachidonic and eicosapentaenoic acids they do not occur in all bryophytes. Acetylenic acids in mosses, as in seed plants, seem to be restricted to a very few genera.

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LIPID COMPOSITION OF PSEUDOMONAS AERUGINOSA RESISTANT AND SENSITIVE TO ANTIBIOTICS. H. SINGH, A.R. SHALITA, J.J. RAHAL and C. HAPCOOK, Dept. of Medicine, New York University School of Medicine and Lipid Metabolism Lab., V.A. Hospital, New York, N.Y. 10010.

There are several reports in the literature that suggest that antibiotic resistance may be related to alterations in lipid composition. In this study the lipid composition of strains of *Pseudomonas aeruginosa* resistant to polymyxin and gentamicin was compared with lipids of strains known to be sensitive to these antibiotics. Isolates of the strains under study were cultured under controlled conditions and the cells

lyophilized. After extraction with chloroform-methanol, the lipids were estimated gravimetrically. The yield of total lipid was similar in both the antibiotic resistant and sensitive strains and averaged 10.5% and 10.6%, respectively. Quantitative and qualitative composition of various lipid classes was determined by thin layer and column chromatography. The phospholipids constituted 32% and 87% of total lipids (p. .001) in resistant and sensitive strains, respectively. Phosphatidylethanolamine constituted greater than 90% of total phospholipid from resistant organisms. The phospholipid composition of sensitive strain was: phosphatidylethanolamine, 60%; phosphatidylglycerol, 15%; cardiolipin, 9–15%. Besides these major phospholipids in sensitive strain, there were at least three other phosphatides. In the sensitive strain, a large amount of lipids not containing phosphorous was also found. These appear to have replaced some of the phospholipid constituents found in the sensitive strains. Further, qualitative and quantitative differences were observed in the fatty acid composition. The sensitive strain contained mainly unsubstituted long chain fatty acids, while the resistant strain had branched chain fatty acids and hydroxy acids. Decrease in phospholipids and replacement by other polar lipids and changes in apolar fatty acid chain part of the membrane lipids can lead to profound changes in cell surface properties of the organism and thus to antibiotic resistance.

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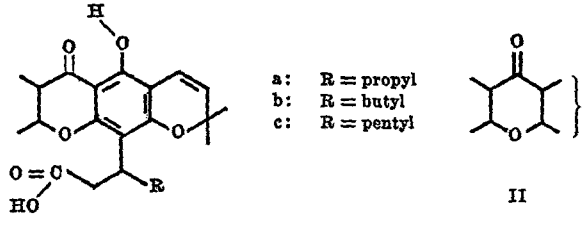
CHROMANONES IN *Calophyllum brasiliense* SEED OIL. R.D. PLATTNER, G.F. SPENCER, D. WEISLEDER and R. KLEIMAN, Northern Regional Research Lab., ARS, USDA, 1815 N. University, Peoria, Ill. 61604.

Unusual nonfatty acids make up ca. 20% of the petroleum ether extract of *Calophyllum brasiliense* Camb. (Guttiferae) seed kernels. The rest of the oil, which is present at a 70% level, is composed primarily of normal free fatty acids and triglycerides. Thin layer chromatography revealed two distinct groups of unusual acids (I and II), type I being present in a far greater amount. The two types could be distinguished by neither gas chromatography nor mass spectrometry, but GC of TLC-separated fractions indicated three homologs of each type. Four of these acids were isolated as methyl esters by countercurrent distribution. They were tentatively identified as Ia (isoapetalic acid), Ib, Ic (blancoic acid) and IIa (apetalic acid) by GC, NMR, IR, UV and MS in comparison with published data. GC-MS demonstrated trace amounts of compounds IIb and IIc, but they were not isolated in pure form. Although compounds Ia, Ic and IIa have been found previously in seeds or bark of other *Calophyllum* species, this report is the first of the occurrence of compounds Ib, IIb and IIc.



I

a: R = propyl
b: R = butyl
c: R = pentyl

II

66

HYDROLYSIS OF TRIACYLGLYCEROLS, CONTAINING Δ9-TETRADECENOIC, Δ5-TETRADECENOIC ACID OR ARACHIDONIC ACID, BY *Geotrichum Candidum Lipase*. ROBERT E. PITAS and ROBERT G. JENSEN, Dept. of Nutritional Sciences, U-17, University of Connecticut, Storrs, Conn. 06268.

Rac-glyceryl-1-palmitate-2-myristoleate-3-oleate, rac-glyceryl-1-palmitate-2-Δ5 tetradecenoate-3-oleate and rac-glyceryl-1-palmitate-2-arachidonate-3-oleate were synthesized and subjected to hydrolysis by *Geotrichum candidum lipase*. Reaction products were separated by preparative thin layer chromatography, and methyl esters prepared and analyzed by gas liquid chromatography. 18:1 was hydrolyzed from all triacylglycerols. 14:1 Δ9 was readily hydrolyzed and accounted for ca. 40% of the free fatty acids, whereas 14:1 Δ5 was not hydrolyzed appreciably (0.75% of FFA) and accumulated in the mono- and diacylglycerols. Preliminary observations are that 20:4 is not hydrolyzed by *Geotrichum candidum lipase*.

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RECENT DEVELOPMENTS IN LIQUID DETERGENT HYDROTROPES. M. MAUSNER, Witco Chemical Corp.

Abstract not available at press time.

68

ORGANIC CHELATES AS BUILDERS FOR HEAVY DUTY LIQUID DETERGENTS. C.S. JOHNSON and J.R. HART, Hampshire Chemical Div. of W. R. Grace.

Abstract not available at press time.

68A

ZERO PHOSPHATE LAUNDRY DETERGENTS: FORMULATION APPROACH USING PVP AND GANTREZ POLYMERS. P.M. CHAKRABARTI, GAF Corp.

Abstract not available at press time.

69

HOME ECONOMIST'S LOOK AT HEAVY DUTY LIQUID DETERGENT. J. CREOLE, Lever Bros. Co.

Abstract not available at press time.

70

SOAP-BASED DETERGENTS: VIII. α-SULFOFATTY ALKANOLAMIDES AS LIME SOAP DISPERSANTS. FRANK D. SMITH, J.K. WEIL and W.M. LINFIELD, Eastern Regional Research Center, ARS, USDA, 600 E. Mermaid Lane, Philadelphia, Pa. 19118.

α-Sulfofatty alkanolamides were prepared by sodium methylate-catalyzed reactions of methyl α-sulfofatty esters with alkanolamines such as ethanolamine, N-methyl-2-hydroxyethylamine, diethanolamine, 3-hydroxypropylamine, 2-hydroxypropylamine and diglycolamine. Pure compounds such as α-sulfopalmitamides and stearamides, as well as the α-sulfotallowamides, were prepared and evaluated as surface active agents. The α-sulfofatty alkanolamides were found to have excellent stability to alkali. Their stability to acid ranged from excellent in the case of α-sulfodiglycolamides to poor in the case of α-sulfodiethanolamides. Poor stability to acid was related to ease of conversion to ester-amines. Washing tests on standard soil cloths showed that the compounds were good detergents by themselves and were also effective in combination with soap and silicates. Their Borghetty Bergman values ranged from 7 to 9%.

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DEVELOPMENT AND TESTING OF PHOSPHATE-FREE HOME MACHINE DISHWASHING DETERGENTS. T.M. KANEKO, BASF Wyandotte Corp.

Abstract not available at press time.

72

EFFECT OF DIFFERENT FATS AND OILS ON FLAVOR OF DEEP FAT-FRIED FOODS. MICHAEL M. BLUMENTHAL and STEPHEN S. CHANG, Dept. of Food Science, Rutgers State University, P.O. Box 231, New Brunswick, N.J. 08903.

An attempt was made to study the effect of different fats and oils used for deep fat frying upon the odor and flavor of fried foods. Moist cotton balls were deep fat-fried in six different oils, separately, to develop fried oil flavor without contributing additional foodstuff flavor. The six oils were corn oil, cottonseed oil, peanut oil and three soybean oils hydrogenated to different iodine values. The fried oils were evaluated by an expert or ganoleptic panel to determine the relative strength and pleasantness of both odor and flavor. The results indicated the panel could differentiate between the odor and flavor produced by different oils. By a saturation technique, reproducible gas chromatograms were obtained from the volatiles isolated from each of the oils. Qualitative as well as quantitative differences in gas chromatographic peaks were observed among the volatiles isolated from the different oils. The odor characteristics of each of the gas chromatographic peaks were determined by an expert panel sniffing the effluent gas. Correlation between the organoleptic evaluation data and the size and retention volume of the gas chromatographic peaks of the volatiles isolated from each oil was studied by computer techniques.

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PILOT PLANT AND COMMERCIAL SCALE REMOVAL OF AFLATOXINS. J.P. HELME and ANDRE PREVOT, Institut des Corps Gras, 5, Bd. de Latour-Maubourg, 75007 Paris, France.

Aflatoxins in peanut meals can be removed by treatment with polar solvents or gaseous ammonia. Among several possibilities, economically interesting solutions were chosen in order to propose a commercial plant. *Extractions* were carried out in a stainless steel apparatus allowing direct extrapolation into a commercial scale de Smet extractor. Numerous extraction series were made with acetone-hexane-water azeotrope and addition of some alkalies. The effect of the number and duration of passes, and the granulometry and the meal-solvent residence time were studied. Commercial conditions resulted in a 50 ppb level of aflatoxin content. Increase of the water and acetone content and introduction of ammonia in the azeotropic mixture allowed reduction of the aflatoxins content to 8 ppb. Unfortunately, with a 60 ton/day French extractor in a Lesieur plant, the azeotropic mixture was not enough active for removing the toxin to acceptably low levels. *Ammoniations* were carried out in a Speichim reactor (25 kg/batch) in an industrial plant. Hundreds of tests were run with expeller and extraction meals in variable conditions of ammonia pressure, water content, reaction temperature and reaction time. Ammoniation easily allowed reduction to below 50 ppb. The soluble nitrogen content decreased with rigor of working conditions. Amino acid determinations showed that lysine degraded by treatment with gaseous ammonia. Water content of meals was the limiting factor. Nutritional tests on rats showed that the food value of the meals was not affected by treatment with polar solvents. Ammoniation, although it gave less rapid growth curves, has judged to be satisfying after zootechnical tests. Examination of organs showed few noxious effects on liver and kidney cells after solvent treatment or ammoniation. In the present state of research, both processes remain possible, ammoniation having a slight advance in technological implications.

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PROPERTIES OF SOME GLYCEROL GLUCOSIDE PALMITATES. JOHN L. WHITE, MONA BROWN and R.O. FEUGE, Southern Regional Research Center, ARS, USDA, P.O. Box 19687, New Orleans, La. 70179.

Glycerol glucoside palmitate products prepared from palmitic acid, esters, glycerol and starch by transglycosylation and interesterification varied greatly in their properties. Therefore one such product prepared with pure palmitic acid was fractionated by liquid-liquid distribution and column chromatography to obtain fractions of mono-, di-, tri- and tetrapalmitates of the glycerol glucosides, and these fractions were characterized. Examination of the monopalmitates crystallized from a solvent revealed a solid-mesophase transition at 45 C, and further heating produced an abrupt mesophase-isotropic liquid transition at 195 C; that is, the monopalmitates existed as liquid crystals over a temperature interval of ca. 150 C. On remelting, the transition at 45 C was again observed, but the behavior at higher temperatures changed. Glycerol glucoside dipalmitates behaved in an analogous manner, undergoing a solid-mesophase transition at ca. 65 C and an apparent mesophase-isotropic solution transition at ca. 95 C. The tripalmitates and tetrapalmitates also exhibited complex melting behaviors. The solid-mesophase transitions of the mono-, di-, tri- and tetrapalmitates required 11.3, 14.0, 17.5 and 20.1 cal/g, respectively. The ability of the glycerol glucoside palmitates to lower the interfacial tension between cottonseed oil and water was measured. The monopalmitates at a concentration of 0.005% in the oil reduced the interfacial tension to one-half that for the oil and water alone. For the di- and tripalmitates, concentrations of ca. 0.03% and 0.4%, respectively, were required. The original mixture of glycerol glucoside palmitates was as surface active as the monopalmitate fraction. The glycerol glucoside tripalmitates still were more surface active than is pure monopalmitin.

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EFFECT OF 2-OLEODIPALMITIN AND 2-ELAIDODIPALMITIN ON POLYMORPHIC BEHAVIOR OF COCOA BUTTER. N.V. LOVEGREN, M.S. GRAY and R.O. FEUGE, Southern Regional Research Center, ARS, USDA, P.O. Box 19687, New Orleans, La. 70179.

The polymorphic behavior of cocoa butter mixed with 2-oleodipalmitin (POP) and 2-elaidodipalmitin (PEP) was investigated with a differential scanning calorimeter. Six mixtures of cocoa butter containing 20, 25 and 50% POP and 10, 25, and 50% PEP, respectively, were used. Each of the three cocoa butter-POP mixtures exhibited three polymorphic forms. The low melting form was obtained by quick chilling; the intermediate, by tempering for several hours just below the melting range; and the high, by raising the temperature slowly up to 25 C overnight or longer. In the cocoa butter-POP mixtures, only the low melting form appeared to be more stable than the corresponding form of pure POP or cocoa butter. In addition to the increased stability of the unstable low forms, the rate of conversion from the intermediate to the high form, normally quite slow, increased in the cocoa butter-POP mixtures. Typical lowering of melting point occurred with the addition of POP. POP was compatible with cocoa butter, and the melting curves were fairly sharp. The three cocoa butter-PEP mixtures appeared to be incompatible. The cocoa butter and PEP behaved like a mixture of two fats, each of which melted independently of the other.

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ISOMERIZATION DURING HYDROGENATION: VII. INDEPENDENCE OF SR AND ISOMERIZATION ABILITY OF NICKEL CATALYSTS. ROBERT R. ALLEN and JESSE E. COVEY, Anderson Clayton Foods, 3333 N. Central Expressway, Richardson, Tex. 75080.

The determination of the selectivity ratios (SR) of many nickel catalysts by hydrogenation of soybean oil under controlled conditions has shown the SR of a catalyst may be high, low or intermediate, but the per cent *trans* unsaturation formed during the hydrogenation is the same at the same I.V. Thus, contrary to accepted theory, the SR and ability to cause geometrical isomerization of a catalyst are not directly related. To study the reaction of high, low and intermediate SR catalysts, samples of oil obtained during the hydrogenations were analyzed to determine fatty acid composition, geometrical and positional isomers formed during the reactions. These results are used to explain the different reactions that occur during hydrogenation that result in the formation of different amounts of saturated and the same amount of geometrical isomers.

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FURTHER DEVELOPMENTS IN VEGETABLE OIL PROCESSING. KARL W. KLEIN and LOIS S. CRAUER, DeLaval Separator Co., Poughkeepsie, N.Y. 12602.

Abstract not available at press time.

77A

ROLE AND FUNCTION OF POLYELECTROLYTES AND COAGULANT AIDS AND WATER POLLUTION CONTROL. JOHN HUGHES, American Colloid.

Abstract not available at press time.

78

ENHANCEMENT OF LIPOGENIC ENZYME ACTIVITIES IN RAT LIVER MICROSOMES. JERRY DARSIE and RALPH HOLMAN, University of Minnesota, The Hormel Institute, 801 16th Ave. N.E., Austin, Minn. 55912.

Because of low lipogenic enzyme activities present in rat liver microsomes, a study was undertaken to enhance the yield of acyl desaturase, chain elongation and chain shortening activities by dietary manipulation and improved homogenization methods. A standard fat-free, high glucose diet was compared with Lab Chow and the Lab Chow:Fast:Glucose regimen described by Sullivan et al. (J. Nutr. 101:2, 265 [1971]). To stress the system maximum chronic oral LD doses of p,p'-DDT (5.1 ppm) and Kelthane (dicofol) (100 ppm) were mixed with Lab Chow of some animals. Excised livers were homogenized with a tube and Teflon pestil on a cell disruption pressure bomb. The resuspended 50,000 × g pellet was used as the microsome fraction. Enzyme activities were increased by as much as 25% over the fat-free diet animals in the Lab Chow:Fast:Glucose animals. Bomb homogenization showed substantial increases of enzyme activities over the Teflon pestil, but showed a reduction in specific activities due to the two- to three-fold increase in the amount of protein harvested.

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ANTIMICROBIAL ACTION OF ESTERS OF POLYHYDRIC ALCOHOLS. JON J. KABARA and ANTHONY J. CONLEY, College of Osteopathic Medicine, Michigan State University, East Lansing, Mich. 48823.

In our studies to delineate the structural relationships involved with antimicrobial activity of fatty acids and derivatives, a number of compounds have been screened. Among the derivatives studied it was found that esterifications of the carboxyl group led to a compound that was less active than the parental fatty acid, monoglycerides were an exception. Further studies showed that esterification of α-hydroxylaurate with methanol does not result in a decrease in activity as esterification of lauric acid with methanol. These observations dealing with the importance of a free functional group led to the studies of antimicrobial action of fatty acids esterified with polyhydric alcohols. The esters studied were: monoglycerides (even carbon chain lengths 2 to 18 + 18:1 and 18:2, tri-, hexa- and decaglycerols (even carbon chain 2 to 12 plus 9) and two sets of sucrose esters (even carbon chain 10, 12, 14, 16, 18:1 *cis*, 18:1 *trans* and 18:2 *cis, cis*). These compounds were tested against both gram positive and gram negative organisms. A normal two-fold broth dilution method was used to determine the minimal inhibitory concentration (MIC). The MIC as defined was the lowest concentration that suppresses macroscopic growth. MIC's are expressed in μmol/ml. Appropriate controls were run. Glycerol, polyglycerol and sucrose esters did not inhibit the growth of gram negative organisms. For gram positive organisms, monoglycerol laurate was the most active compound in this series. The shorter chain length glycerols-acetate and butyrate were inactive as was the longer stearate. Oleate and linoleate esters showed slight activity. In each class (tri-, hexa-, deca-) the acetate and butyrate esters were inactive except for the inhibition of group A streptococcus by decaglycerol butyrate. From chain length 8 to 12, the inhibition is relatively constant. The higher chain length polyglycerol, triglycerol oleate, was inactive. When active, sucrose esters, except for laurate, are more active than the free fatty acid. Contrary to previous experience, both *cis* and *trans* 18:1 sucrose esters were active. None of these esters inhibited Staphylococcus aureus or group D streptococcus.

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HYDROCARBON COMPOSITION OF HAIR LIPIDS FROM CAUCASIAN AND NEGRO BOYS. LEON L. GERSHBEIN and K.L. SHELADIA, Northwest Institute for Medical Research, 5656 W. Addison St., Chicago, Ill. 60634.

Two pools each of hair from 31 Caucasian and 26 Negro boys, 13–17 years of age, were collected at a state school under carefully controlled conditions so as to minimize lipid contamination. Hair was cut with degreased scissors and to the exclusion of any machine clippings whatsoever, and the lipids extracted exhaustively with ethyl ether. The recoveries for the Negro pools were 7.1 and 7.7% and for Caucasian boys, 2.4 and 3.3%. The lipids were saponified, the hydrocarbons removed by chromatography of the unsaponifiable portion over alumina and further fractionated by silica gel as detailed earlier (Gershbein et al., J. Gas Chromatogr. 3: 378 [1965]; J. Chromatogr. 27: 451 [1967]; Dermatologia 140: 264 [1970]). As based on the weight of hair processed, the total hydrocarbon levels amounted to 0.45–0.57% and 0.19–0.20% for the Negro and Caucasian pools, respectively, or 32.3–46.7% and 25.5–34.7% in the unsaponifiables, in the order stated. The saturated hydrocarbons ranged higher in the Negro pools (55–67%) than in those from Caucasian boys (4–24%). On the other hand, squalene, the most prominent olefin in all pools, made up 61–91% and 33–45% of the Caucasian and Negro total hydrocarbon contents, respectively. The samples were analyzed by temperature-programed GC over a range of 140–310 C, the rate of heating being 2 C/min (6 ft glass U-shaped column; packing, 3% SE-30 on 80–100 mesh Gas Chrom P; carrier gas, He at 80 ml/min; H flame detector). Further resolution of the saturated hydrocarbons into normal and branched components was afforded by use of a short precolumn containing 40–60 mesh molecular sieves (Linde 5A) and maintained at 250 C. From the analytical data, the presence of at least two homologous series (5–18%) could be observed, which also consisted of cyclic and branched components, the latter being prominent in pristane and phytane. The major homologous series, which represented 82–95% of the saturated members, comprised the *n*-alkanes displaying chain lengths of C_{15} to C_{35} for the Caucasian male pools and from C_{15} to C_{44} for the mixtures from Negro boys.

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LIPIDS OF GREEN AND ROASTED COFFEES. LEON L. GERSHBEIN and K. BABURAO, Northwest Institute for Medical Research, 5656 W. Addison St., Chicago, Ill. 60634.

Green and roasted Brazilian, African and Hawaiian ground coffees in addition to decaffeinated blends were extracted with chloroform-methanol 2:1 or ethyl ether, cold batch or Soxhlet being employed with the latter solvent. Neither solvent system nor extraction method appeared to influence the lipid yield, which ranged from 6% for green decaffeinated batches up to 14% for roasted Brazilian coffee on a weight basis. Following alkaline hydrolysis, the fatty acids were isolated, esterified and analyzed by GC. The prominent acids in each sample comprised: 16:0, 22–31%; 18:0, 7–13%; 20:0, 2.9–5.2%; 18:1, 8–18%; 20:1, 1.8–9.8% and 18:2, 34–45%; palmitoleic and branched chain acids were essentially undetectable. The unsaponifiable material, constituting 3–11% of the lipids, was fractionated over activated alumina and the hydrocarbons separated from the alcohol + sterol portion. Concentration of the saturated hydrocarbons was affected by silica gel chromatography and such components were submitted to temperature-programed GC employing an SE-30 packing (140–310 C; rate of heating: 2 C/min). The branched members were analyzed by way of an on-the-line preheated column packed with molecular sieves (Linde 5A). Of the saturated hydrocarbons, the main portion, 65–88% of the total, comprised the normal and cyclic members occurring over a range of C_{14}–C_{35} (20 peaks), of which C_{17}, C_{18}, C_{19}, C_{20}, C_{23}, C_{27} and C_{29} predominated. The remainder were branched chain series ($C_{14.6}$–$C_{31.4}$; 26 peaks) homologs eluting after C_{23} occurred in trace amounts. Squalene was the main unsaturated hydrocarbon.

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COMPARISON OF LIPOXIDASE ENZYMES FROM VARIOUS SUPPLIERS IN DETERMINATION OF ESSENTIAL FATTY ACIDS IN EDIBLE OILS. ROBERT C. MEES and WILLIAM R. PURVIS, Lever Bros. Co., 45 River Rd., Edgewater, N.J. 07020.

A statistically designed experiment was conducted to assess the effect of using lipoxidase enzymes from various suppliers in determining the essential fatty acid content of edible oils. A modification of the "Canadian" enzymatic method was used for this work. Two edible oils and three margarines were analyzed using five different batches of enzyme from four suppliers. Data indicate that four of the enzymes give the same results within experimental error, while one gives a different level of results. This difference is not quite significant at the 95% confidence level but is significant at the 90% level. Problems encountered and modifications in the method will be discussed.

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ASSESSMENT OF LIPOLYSIS BY DIRECT GAS CHROMATOGRAPHY OF REACTION PRODUCTS ON POLAR COLUMNS. N. MORLEY, A. KUKSIS and J.J. MYHER, Banting and Best Dept. of Medical Research, 112 College St., Toronto 101, Ont., Canada.

Individual synthetic diglycerides and mixtures of enantiomers were emulsified with lyso(1-acyl)lecithin and subjected to hydrolysis with lipoprotein lipase. At various time periods the reaction products were isolated along with the starting materials, trimethylsilylated and examined by gas chromatography on 3% SILAR 5CP on Gas Chrom Q in the temperature range 180–275 C. The stereochemical course of the lipolysis was assessed on the basis of the gas chromatograms, which

gave complete separations based on molecular weight and degree of unsaturation for free fatty acids, monoglycerides and diglycerides. In addition, the monoglycerides were resolved according to the position of the acyl group on the glycerol molecule, while the diglycerides permitted an estimation of the content of the different enantiomers. The results showed that lipoprotein lipase attacks preferentially the 1 position in X-1,2- and X-1,3-diglycerides. The hydrolysis of the X-1,2-diglycerides was accompanied by a transient accumulation of the 2-monoglycerides, which required isomerization to the 1- or 3-monoglycerides prior to hydrolysis. In all instances the time course of the reaction was influenced by the nature of the fatty acids involved. The release of fatty acids from the 1 position was in the order stearic > oleic > palmitic. The above method is also suitable for the examination of the lipolysis products of natural glycerides, but a complete resolution of positional isomers of homologous monoglycerides may not always be obtained.

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APPLICATION OF HIGH SPEED LIQUID CHROMATOGRAPHY TO ANTIOXIDANT DETERMINATIONS. R.H. BOWERS, Swift & Co., R&D Center, 1919 Swift Dr., Oak Brook, Ill. 60152.

Recent advances in instrumentation have led to a renaissance in the application of liquid column chromatography to quantitative analyses of a wide variety of materials. This paper discusses recent work on the application of high speed liquid chromatography to antioxidant determinations. The antioxidants studied include a number of widely used synthetic agents such as BHA, BHT, propyl gallate and TBHQ. Quantitative separation and determination of these antioxidants will be discussed with regard to those solvent systems and stationary phases investigated. A discussion of the instrumental configuration will also be presented. The inherent advantages of speed and precise quantitation provided by high speed liquid chromatography should make this a most attractive technique for the analysis of a number of substrates for added levels of antioxidant.

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DETECTION OF ALDEHYDES IN TLC WITH 4-AMINO-3-HYDRAZINO-5-MERCAPTO-1,2,4-TRIAZOLE (AHMT). C.H. RAHN and H. SCHLENK, University of Minnesota, The Hormel Institute, 801 16th Ave. N.E., Austin, Minn. 55912.

Aldehydes are detected as purple spots in chromatograms of lipids when sprayed with 4-amino-3-hydrazino-5-mercapto-1,2,4-triazole (AHMT). The reagent is used for spraying as a 2% solution in 1N NaOH, and the color reaction makes clearly visible less than 1 μg palmitaldehyde on thin layer chromatograms. Less than 5 nmol of aldehyde are detectable without interference of other lipids in chromatograms of lipids from incubation mixtures. Plasmalogens give the purple color with AHMT only after acidic hydrolysis of the vinyl ether bond. AHMT does not react with ketones except α-hydroxyketones or other structures where rearrangement to aldehydes is possible in NaOH. AHMT produces purple or red colors also with ozonides and can be used in conjunction with chromatography to monitor their reduction to aldehydes. Autoxidized lipids and lipids autoxidizing on the chromatogram slowly give the aldehyde reaction, but misinterpretations are easily avoided by simple precautions and consideration of R_f values. AHMT may have advantages over 2,4-dinitrophenylhydrazine for detection of aldehydes due to its greater specificity and sensitivity.

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FLAVOR SCORE CORRELATION WITH PENTANAL AND HEXANAL CONTENTS OF VEGETABLE OILS. C.D. EVANS, K.A. WARNER, G.R. LIST, H.P. DUPUY, J.I. WADSWORTH and G.E. GOHEEN, Southern Regional Research Center, ARS, USDA, P.O. Box 19687, New Orleans, La. 70179.

Cottonseed, peanut and soybean oils were evaluated by a 20 member taste panel for initial flavor scores after deodorization in the laboratory and for aged flavor scores after storage. These oils were examined for their pentanal and hexanal contents by an enrichment gas chromatographic technique. Oils were aged for 2, 4, 8, 12 and 16 days in the dark and tested immediately after storage. The effects of antioxidants and citric acid on flavor and aldehyde development were investigated, and correlation coefficients were calculated for each series of treated oils. The overall correlation coefficients of flavor scores of all oils with the logarithm of their pentanal and hexanal contents were 0.79 and 0.81, respectively. For soybean oil, these coefficients were 0.96 and 0.92; for cottonseed oil, 0.60 and 0.86; and for peanut oil, 0.74 and 0.75. Most coefficients were statistically significant at the 1% level.