Edible Rendering[1]

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History

Rendering may be defined as the process whereby fat, water, and protein material are separated from the fatty or adipose tissue of animals. This discussion will deal primarily with land animals and with the edible and fresh tissues of those animals.

Meat has been a human food since the dawn of history, and there is no reason to suspect that Adam and Eve did not eat some meat. The use of fat from the meat of land animals extends back to ancient times. Cattle, swine, and sheep were brought to North America late in the 15th century and early in the 16th. These animals were the forebears of the domestic meat animals of colonial times and of more recent times.

The early meat packers in the United States were farmers who began preserving meat by curing it with salt. Not only was meat from cattle and swine so packed but also venison and bear. As cities grew, the need for shipment of meat from the rural areas to central points became apparent. These distribution points gave way to slaughter houses in the cities where fresh meat was sold. With the advent of ice refrigeration and later mechanical refrigeration and the refrigerated railroad car, the transportation of fresh meat from city to city became a reality.

The fatty tissue from meat animals which is not a part of the carcass or which is trimmed off of it in preparing the carcass for market is the raw material from which lard, tallow, and pork fat are rendered.

In rendering fatty tissue for the production of edible fats, it is always economically desirable to obtain the maximum yield together with a light-colored fat of low free fatty acid and low peroxide value. The odor of the fat is of prime importance today, especially in the case of lard, much of which is sold per se without further processing other than filtration. To accomplish this the fats should be rendered as soon as possible after availability. In the case of the splitting of the fat to fatty acids and glycerin, this process starts the instant the animal is killed and proceeds at even, low temperatures. A lipolytic enzyme present in the tissue is responsible for this reaction. Figures 1 and 2 demonstrate the free fatty acid development.

Open-kettle rendering was probably the first rendering process and is essentially that of cooking the tissues and evaporating off the water. It, when adopted by the packing houses, was essentially an enlargement of the wood-fired units used on the farms. As centralized packing plants increased in size, power plants developed, jacketed kettles were heated with steam, and later mechanical agitators were provided to prevent localized over-heating. The common operating procedure was to turn on the steam and then add the hashed fat until the kettle was completely charged.

In the early stages of cooking most of the water is rapidly boiled away. In the later stages the temperature rises slowly above 212F, and when this point is reached, the jacket temperature is reduced to prevent scorching. A temperature of 240F should never be exceeded. There is no satisfactory method of determining the optimum end-point. It is somewhat of an art in kettle rendering. The end-point is reached when the cracklings are dry enough to be pressed. Normally about three hours are required to reach this point. The contents are then dropped into a strainer box, where the liquid fat runs to a receiving tank. Further clarification may be made by filtration. The cracklings are pressed for further fat removal.

Little, if any, kettle rendering is practiced commercially today especially since the M.I.D. decision of a few years ago to allow lard rendered without pressure in dry melters to be designated as kettle-rendered. This type probably has only one plus characteristic, and this only to some people, a strong pork-like flavor.

Steam Rendering

Steam rendering of tissues has and probably still is the most used method today. This is also known as wet rendering. It consists primarily in heating the tissue directly with live steam under pressure in cone-bottomed vertical tanks at pressures from 30 to 60 psi. The tanks are equipped with a charging door, a vent line, and safety valve on top, draw-off valves on the side, steam inlets in the lower part of the cone, and a gate valve on the bottom for drawing off the tankage and water.

The hashed or unhashed fats are charged into the tank to a level of about three feet from the top. The door is then closed and live steam turned on through the inlets near the bottom of the tank; the vent line at the top of the tank is opened wide until all of the air has been replaced with steam. The vent is then closed, and the pressure gradually builds up. Hashed fats may be rendered in one hour, but unhashed fats require about three hours.

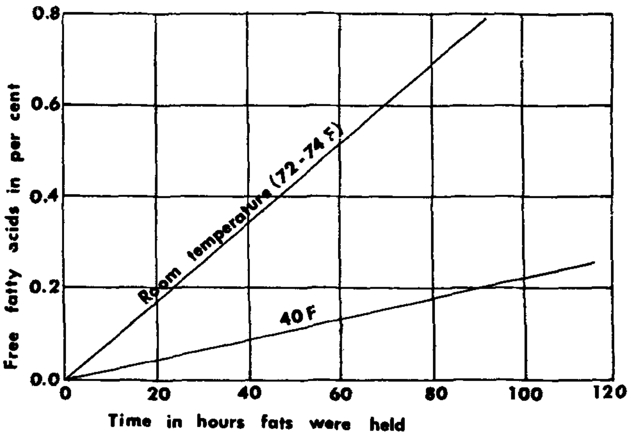

FIG. 1. Free fatty acids, produced in leaf fat held at room temperature and at 40F.

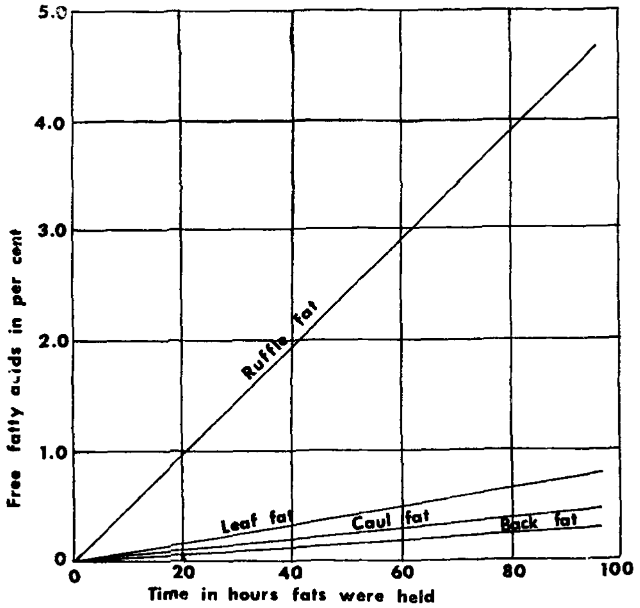

FIG. 2. Free fatty acids, produced in caul, leaf, ruffle, and back fats when held at 34F.

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[1] Presented at the AOCS Short Course, "Processing Quality Control of Fats and Oils," East Lansing, Mich., Aug. 29–Sept. 1, 1966.

[2] Present address: Wilson & Co., Chicago, Ill.

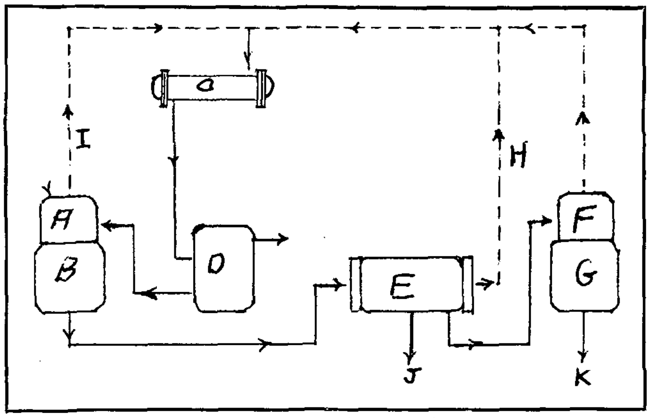


FIG. 3. Schematic drawing of the Vio-Bin process. A—Animal Material, B—Solvent Cooker, C—Condenser, D—Solvent Work Tank, E—Solids Dryer, F—Micella, G—Fat Kettle, H—Solvent Vapors, I—Solvent and Water Vapors, J—Meal Solids, K—Recovered Fat.

Wet rendering is a simple, rather fool-proof process. Any and all kinds of fatty tissue can be so rendered without any special precautions. The large amount of water present makes it impossible to burn the fat, and about the only thing over-cooking will do is increase the free fatty acid content. A study made years ago by using 47 psi steam pressure indicated the free fatty acid rise to be about 0.06% per hour.

In concluding the cook, the steam is turned off and the vent line partially opened. The pressure must not be reduced too rapidly, or the tank water boils up into the fat and produces emulsions difficult to break. After the tank water and tankage have separated, the clear fat is run off through draw-off cocks on the side of the tank. Water is usually run into the bottom of the tank to raise the fat level, if necessary, to a position where it will run out. The fat, as it leaves the rendering tank, may either be run through a separator or simply into a tank equipped with steam coils where it may be settled and dried.

Steam-rendered fats have a characteristic flavor and odor. Commercially they are very acceptable. The greatest disadvantage to steam rendering is the disposal or utilization of the tank water and wet tankage. This may be a substantial problem. Typical specifications for wet-rendered lard and tallow are given in Table I.

Dry Rendering

Dry rendering is another method which is extensively practiced. A dry melter is used, which is a horizontal steam-jacketed tank with a charging door, vent line, and discharging door. It has mechanical arm agitators extending the length of the tank to stir the material and keep the shell clean for good transmittance of heat. Dry melters are made in various sizes; so one can be purchased which will handle up to about 12,000 pounds of fat per charge. And the turn-over time on a dry melter is approximately four hours.

There is no limitation on the type of fats that may be rendered in a dry melter, and the fats may or may not be hashed. But since small pieces of fat always render more quickly and uniformly than large pieces, many operators hash the fats as they are charged into the melter.

Dry melters may be and are operated in a number of different ways. For example, cooking may be done under pressure, at atmospheric pressure with the vent open, or under vacuum. And the cook may be finished at atmospheric pressure or under vacuum. No matter what operating procedure is used, the temperature of the fat must not get too high. If rendering is done at too high a temperature, the fat will darken and will possibly be scorched. The steam pressure in the jacket is controlled so that the temperature in the tank, except when the initial cooking is done under pressure, never gets above 240F.

TABLE I

	Lard	Tallow
Odor and flavor	Not sour or staggy	Not sour
Color (red) max.	1.5	*1.0[a]
Peroxide value (mg/kg) max.	3.0	6.0
Moisture (%) max.	0.15	0.15
Insoluble material (%) max.	0.05	0.05
Iodine value	62–66	38–52

[a] Bleached.

TABLE II

	Color red	Peroxide value	Stability A.O.M.	"Protein" ppm
D. R. Lard A	3.5	1.8	7	658
D. R. Lard A Water-washed	1.0	1.9	2	10
D. R. Lard B	2.8	2.0	8	150
D. R. Lard B Water-washed	0.4	2.0	3	9
P. S. Lard	1.2	3.4	3	7
P. S. Lard Water-washed	1.2	3.4	3	7

The hazards of dry rendering involve the determination of the proper end-point. If cooked too much, the fat will be dark and will solubilize the phospholipids, which are soluble in fat when dehydrated. If cooked too little, pressing of the cracklings is difficult. Today electrical devices are used, which are based upon the conductance principle, to estimate optimum cooking.

Two hazards as to quality exist in dry-rendered lard: a) dissolved phospholipids, which unless removed by water washing, contribute to color rise in further processing and b) a tendency for the peroxide value to rise in shipment or holding tanks if water washed. Table II shows the nonfilterable protein (nitrogen × 6.25) content of dry-rendered lard compared with prime-steam lard. It also shows the effect of water washing on color and stability.

A holding test made on some water-washed, dry-rendered lards shown in Table III shows the effect of various temperatures on stability and color. Thus it can be seen that dry-rendered lard per se is quite stable on holding. The phospholipids act as antioxidants. However the color tends to creep up on holding. Water washing corrects this, but a highly perishable products results. Unless dry-rendered lard is water-washed however, its use in shortening products where low color standards are to be met is practically precluded.

Vio-Bin Process

Perhaps one other rendering process should be mentioned before the modern centrifugal methods. This is known as the Vio-Bin process. It has potential application to edible rendering although at the present time it is confined primarily to inedible. This process is based upon the fact that ethylene dichloride and water form an azeotropic drawing of the process. Figure 3 is a schematic drawing of the process. Figure 4 is a more detailed sketch of the process.

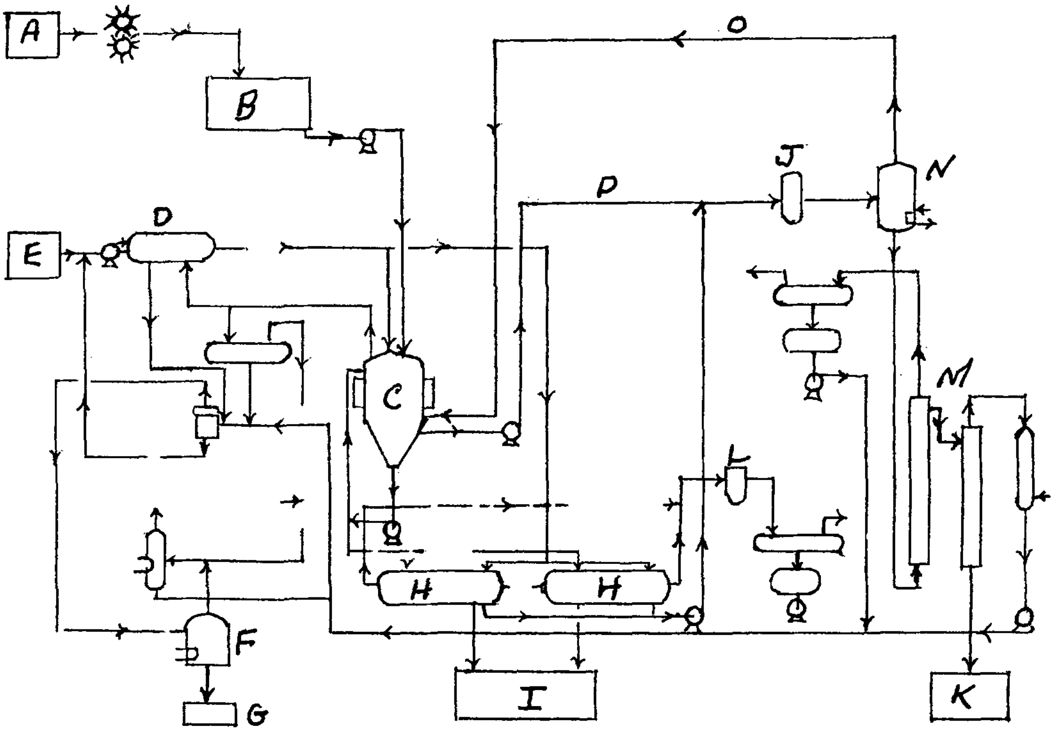
As indicated on the flow chart, the prepared animal material and a measured quantity of solvent are loaded into the solvent cooker and heated to boiling by indirect steam which flows into the jacket of the cooker. The solvent will boil off with the water from the animal tissue at a constant temperature (and atmospheric pressure) appreciably below the boiling point of either the solvent or water. When practically all the water has been extracted from the tissue, the temperature will rise, driving off residual quantities of water.

The hot solvent which remains in the cooker dissolves the available fat from the animal tissue. This liquid solution of fat and solvent is known as miscella. When a temperature near the boiling point of solvent alone is reached, the cook is finished. The cooked batch of miscella and meat solids is discharged into a revolving type of dryer. From this the miscella are readily drained from the solids though a filter cloth, supported in the dryer, and are then pumped as a clear, fines-free liquid into the fat kettle, where fats are recovered.

TABLE III
Held three days at 98F, 122F, 140F

	Original		98F		122F		140F	
	Color	P.V.	Color	P.V.	Color	P.V.	Color	P.V.
D. R. Lard	1.1	1.0	1.2	1.0	1.5	1.1	2.5	1.1
D. R. Lard (washed)	0.5	1.0	0.5	2.0	0.5	15.6	0.2[a]	52
Prime steam lard	1.0	2.2	1.0	3.2	1.0	10.2	1.0	15.2

[a] Product rancid.



Viobin
Azeotropic Process
Semi-Continuous
Up To 100 Tons/Day
Raw Material

Fig. 4. Details of the Vio-Bin process. A—Raw Fish, B—Ground Fish, C—Cooker, D—Solvent Preheater, E—Solvent Make Up, F—Still, G—Water, H—Desolventizer, I—Finished Meal, J—Filter, K—Finished Fat, L—Dust Catcher, M—Concentrator and Stripper, N—Micella Evaporator, O—Solvent Vapor, P—Micella.

Several cooker batches are pumped into the dryer, and the miscella from each are drained from the meat solids into the fat kettle. If a low fat product is desired, the solids may be washed with one or two portions of solvent, and this drained liquid may be used as solvent for new batches in the cooker.

The solvent wetting the meat solids in the dryer is vaporized with jacket steam as the drying unit rotates. To effect complete removal of solvent from the solids, the inner shell of the dryer is put under vacuum and open sparge steam is also used. At the end of the operation the solids are unloaded from the dryer and may be given a final grind before sacking and shipment.

The combined batches of miscella in the fat kettle are heated by jacket steam to boil off most of the solvent from the fat. The material is further heated under vacuum to remove most of the remaining solvent; final traces of the latter may be removed by open-steam sparging of the fat at vacuum conditions. The fat is then run into the receivers without settling, filtering, or brine washing as a finished crude fat.

TABLE IV

Typical Results of a De Laval Continuous Centriflow Process for Edible Fat Production (Straight Rendering)[a]
(180F Operation)

Main Product	Lard	Edible Tallow
Raw material on 1,000-lbs. basis	1,000 lb	1,000 lb
Weight of final products		
Recovered fat	778 lb	840 lb
Cracklings	92 lb	97 lb
Stick water	151 lb	138 lb
Sludge	60 lb	12 lb
Total:	1,081 lb	1,087 lb
Condensed steam	81 lb	87 lb
Percentage by wt of raw material	8.1%	8.7%
Cracklings	92 lb	97 lb
Fat content	6.9%	8.0%
Fat loss	6.3 lb	7.8 lb
Stick water	151 lb	147 lb
Fat content	3.8%	.9%
Fat loss	5.2 lb	1.3 lb
Sludge	60 lb	12 lb
Fat content	25%	1.8%
Fat loss	15 lb	.2 lb
Total loss of Fat	26.5 lb	9.3 lb
Total fat in raw material—"Recovered Fat + Total Loss of Fat"	804 lb	849 lb
Total fat content of raw material	80.4%	84.9%

[a] Results are based on 1,000 lbs. of raw material.

Solvent vapors from the dryer and the fat kettle, as well as those mixed with water vapor from the cooker, are condensed, and the liquid formed is run into the solvent work tank. The water, which does not dissolve in the solvent, separates readily and, when the heavier chlorinated solvents are used, floats to the top of the tank, from which it is discharged periodically. The solvent is used again for treating more animal material in the cooker.

The quality of the protein by this process is better than by conventional methods, but the fat for the most part is dark-colored and requires further treatment.

Drip rendering, enzyme rendering, and some others have been practiced in the past, and they are only mentioned in passing to the modern continuous methods.

De Laval and Sharples Systems

Two systems, basically the same in principle but differing in the equipment used, are in common use in the United States. One has been engineered by the De Laval Separator Company and the other by the Sharples Division of the Penn Salt Company. There may be other systems available, but this discussion will be confined to these two.

Figure 5 shows a schematic representation of the De Laval system. Fat trimmings are minced, heated to 80–100F depending on product requirements, and pumped to the thermal disintegrator. This disintegration shreds the tissue, freeing the fat for ideal separation in the De Laval desludger. The desludger AFNX is a horizontal, conical bowl centrifuge with a screw-type conveyor for

TABLE V

Yield of Fat	Lard	Tallow
Weight of recovered fat = fat in raw material	97.0%	99.0%
Weight of recovered fat = total weight of raw material	80.4%	84.0%
Free fatty acid content (FFA)[a]	.09%	.10%
Free moisture content of the fat	0.04%	0.07%
Colour Lovibond 5¼-in. cell		
Yellow	3.0	35
Red	0.3	3
Blue	0.0	0
Peroxide value		
of raw material after mincing	0.08	0.09
of final separated fat	0.08	0.09

(Continued on page 430A)

By Which We Live

(With the passage of extensive revision of the AOCS Articles of Incorporation and By-Laws, it was felt that comment by the Chairman of the Committee in charge of this difficult project would be most revealing to the membership.)

THE CONSTITUTION or the Articles of Incorporation and the By-Laws are the rules by which any organization, whether it be the United States of America or the American Oil Chemists' Society, exists and conducts its business. The Articles of Incorporation define the authority by which we exist. They define our purpose, our membership, our *modus operandi* and, insofar as we are able to predict, or as we are required by law, the length of our existence. In many organizations the Articles of Incorporation and By-Laws are subject to the changing opinion of individuals within the framework of the organization while in certain other instances changes in the Articles of Incorporation and the By-Laws can be made only by the consent of those governed. The Articles of Incorporation and the By-Laws of the American Oil Chemists' Society fit this latter category. Normally changes can be made and are made on suggestion by any member of the Society in writing to the Governing Board which then determines whether such changes would be advantageous to the Society and if a decision is in the affirmative, such changes are presented to the membership of the AOCS for their approval or disapproval. To maintain a healthy and growing Society, it is important that both the Articles of Incorporation and the By-Laws be reviewed at regular intervals. These documents must "keep pace" with the organization they govern.

R. C. Stillman

It is the purpose of this commentary to point out the scope of the 1968 revisions and to emphasize the need for complete review at fixed time intervals.

In April of 1957 and again in October of 1964 certain changes were made in the Constitution and By-Laws of the Society. These changes were minor in nature and extremely limited. They were, in fact, important in a sense that they did bring about needed relief, but in a way that constituted only a "patching up" of an existing situation with little regard to the need for a more thorough revision. Such a procedure while limited in nature is, however, necessary to accomplish an immediate purpose. A more extensive review of the Articles of Incorporation and By-Laws of the Society should be undertaken at fixed intervals of not more than 10 years in order to insure that the Society's rules of operation are consistent with its intent.

Changes in the constitution as it existed in 1967 were designed to accomplish several things: First, to change the terminology "Constitution" to "Articles of Incorporation"; secondly, to make the Articles of Incorporation consistent with Louisiana law; and thirdly, to re-define the Society and its purposes in the light of present day sophistication. While these were the main objectives in the changes, certain other changes were made which will be discussed in more detail later in this commentary.

Changes in the By-Laws were designed to make the existing By-Laws easier to amend, consistent with the Articles of Incorporation, and to provide for needed changes in the rules by which we operate and anticipate changes necessary for future operation including the addition of committees and sections.

To go back to the actual considerations involved in the Articles of Incorporation, one must consider that as the laws of incorporation within a state change, the Articles of Incorporation necessarily must change to conform. The American Oil Chemists' Society is a Louisiana Corporation. Under the present laws under the State of Louisiana one must not only specify in the Articles of Incorporation the names of its registered agents, but the specific address of the registered office in a Louisiana city. In any Articles of Incorporation the duration of that corporation must be specified. This may be changed at any time and in the present law it is allowable to specify 99 years from the day of revision. Hence, the present American Oil Chemists' Society under Louisiana law is entitled to exist for 99 years from the date of which the 1968 revisions were adopted.

In the 1967 Constitution provision was made for the appointment of an Executive Officer of the Society. This officer was designated as the Executive Secretary. This terminology was exceedingly limited in scope and as a consequence the Governing Board decided that the terminology of Executive Director was more meaningful and more correct. Certainly such a change exemplifies the need for a careful consideration in all revisions of the terminology of people, officers and committees which are provided for in either the Articles of Incorporation or the By-Laws of the Society.

While in most instances the words used to define the procedures of the organization are adequate, under circumstances they become exceedingly limited in the way in which they must, by definition, be applied. Previously, the Spring Meeting of the Society was defined in the Constitution as the Annual Meeting. A change in the Articles of Incorporation was necessary to allow not only for meetings other than spring meetings to be defined as the annual meetings in the By-Laws, but eliminates as well the presumption that a Fall Meeting is a necessity under the Articles of Incorporation.

Having disposed of the considerations which go into the drafting of or revision of Articles of Incorporation, one must make certain that the By-Laws of the Society are adequate to operate by and are consistent with the Articles of Incorporation. One must be careful as well to insure that the By-Laws comply with the incorporation laws of the state involved. In general, however, the By-Laws must be less difficult to change because of the need to meet conditions as they exist and change from year to year. In the 1968 revisions one of the most significant changes was that which provided for amendments to the By-Laws as set forth in Article 10. While it was previously necessary to send notice of all changes in writing to all members of the Society and to obtain their proxy for or against the proposed amendments and while it was necessary for the proposed amendment to receive a favorable vote of two thirds of the members of the Society present at the meeting either in person or by proxy for its approval, the new procedure provides for only notification by publication in the *JAOCS* and a favorable vote of the majority of the members voting at the designated meeting for approval. This simplifies tremendously the process by which By-Laws can be changed and at the same time sacrifices nothing from the standpoint of Society approval. Equally important, the added flexibility of the By-Laws allows the Articles of Incorporation to be just that much more firm.

As the Society grows in number and in complexity it

(Continued on page 463A)

AOCS Short Course on Quantitative Analysis of Lipids by Gas Chromatography

The Short Course will be held at the Pocono Manor Inn, Pocono Manor, Pennsylvania, October 16 to 19, 1968 just prior to the AOCS Fall Meeting in New York. The time and location of the course will make it convenient for course registrants to also attend the AOCS meeting. It will start on the morning of October 16th and will end at noon on the 19th allowing approximately one day sightseeing between the two functions.

The course is not specifically for novices, nor is it a summary of research results. The entire program is designed to stress the problems and requirements for obtaining quantitative data in contrast to just obtaining chromatograms. The first day of the program will stress the problems associated with analysis and quantitation of all types of compounds. The balance of the program includes discussions of analysis of specific lipid classes and the problems associated with quantitative analysis of these compounds.

In addition to the formal program, there will be evening bull sessions or panel discussions to allow registrants an opportunity to probe more deeply some of the problems they may have.

The program includes:

Selection and Preparation of Supports, Packings and Columns—W. R. Supina, Supelco, Inc.

Characterization of Detectors and Output Systems;

Techniques for Quantitation: A Review of Integration Techniques; and

Use of Computer Systems for Quantitation and Automation—J. M. Gill, Varian-Aerograph.

Programmed Temperature G. C.—Harold McNair, Varian-Aerograph.

Developing a Quantitative Analytical Method (A discussion on the selection and use of internal and external standards and determination of accuracy and precision required.)—Gerald Umbreit, Greenwood Laboratories, Inc.

Introduction to Lipids: Structure and Characterization—Nicholas Pelick, Supelco, Inc.

Bile Acids—Arnis Kuksis, University of Toronto.

Amino Acids—D. Stalling, Fish Pesticide Lab.

Carbohydrates—C. C. Sweeley, Michigan State University.

Micromethods, Microsamples and Associated Problems—G. Feldman, Baylor University College of Medicine.

Steroids—W. J. A. VendenHeuvel, Merck Sharp & Dohme Research Institute.

Fatty Acids, Structure Determination by Ozonolysis, Pyrolysis and Other Techniques—H. J. Dutton, USDA, Peoria.

Fatty Aldehydes and Acetals—V. Mahadevan, Minneapolis VA Hospital.

The registration fee for the course is $140.00 and covers lectures, room and board and all gratuities. Those interested in attending for one day only will be charged $50.00 per day. Family members are welcome; cost is $85.00 per person for the duration of the course.

Additional details on the course can be obtained from the Chairman, W. R. Supina, Supelco, Inc., P. O. Box 628, Bellefonte, Pennsylvania 16823.

Information on accommodations and local arrangements can be obtained from the Local Arrangements Chairman, Frank Naughton, Baker Castor Oil Company, 40 Avenue A, Bayonne, New Jersey 07002.

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NEW BOOKS

edited by F. W. Quackenbush

SURFACE CHEMISTRY, PROCEEDINGS OF THE SECOND SCANDINAVIAN SYMPOSIUM ON SURFACE ACTIVITY, Stockholm, November 18–19, 1964. Editors Per Ekwall, Kjell Groth and Vera Runnström-Reio, Academic Press, New York and London, pp. 315, 1965, price?

A short preface indicates the ". . . . hope that the publication of these proceedings will further stimulate the interest in surface chemistry and will show still more chemists the advantages of using the methods of surface chemistry, so that there will be a still larger number of participants at the third symposium which will probably be arranged in Denmark."

This is a diverse and uneven hard cover collection of 25 papers varying in length from 4 to 28 pages. The papers are generally although not always well-referenced. Appended discussion, which appears with several, is sometimes salty, sometimes informative. Thus ". . . . [Author]: No, you don't. [Discussant]: Well, as a matter of fact in all the handbooks . . . . [Author]: Yes, in handbooks, but they are all wrong. . . ."

So varied are the topics that no general review is possible. Among the 25 titles one finds *"Some Aspects on the Physics of Frost Heave in Mineral Soils," "The Choice of Surfactants for Different Purposes," "The Relation between Polymorphism in 'Two-Dimensional' Monomolecular Films on Water to Polymorphism in the Three-Dimensional State."*

Many of the papers are of limited or transient merit, but a few are of wide interest and lasting value, e.g., the aforementioned one on *"Two-Dimensional Monomolecular Films"* by M. Lundquist, *"Chemisorption of Collectors"* by C. du Rietz, *"Phase Equilibria in Aqueous Three-Component Systems of Amphilic Substances"* by L. Mandell.

This is a book for specialists in the field of Surface Chemistry or for large laboratories of diverse interests in that area.

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CHEMICAL MARKETING RESEARCH, edited by N. H. Giragosian (Reinhold Publishing Corp., New York, 375 p., 1967, $12).

The Table of Contents presents a readable breakdown of the chapters and applicable subheadings, leading to a more rapid utilization of the information presented. The 15 chapters proceed from an updated assessment of the basics of the chemical industry through a survey of how the research is performed, the interrelationship between marketing research and corporate planning, and finally is concerned with changes in the nature of the research, computerization, and application of this research in forward integration.

This valuable reference is sponsored by the Chemical Marketing Research Association to update trends in marketing research previously described in an Association-sponsored book published in 1954. Assessed in the current volume are present and projected future trends in this research area: fully meeting the needs of the research specialist in this area.

The chapter headings are descriptive and are supplemented by page-referenced subsections. Chapter 1 concerns Basic Characteristics of the Chemical Industry; Chapter 2, The Nature and Scope of Marketing Research; Chapter 3, the Changing Nature of Marketing Research; Chapter 4, Information Sources; Chapter 5, Methodology, Tools and Techniques; Chapter 6, Communicating Marketing Research Results; Chapter 7, Managing the Marketing Research Department; Chapter 8, Chemical Economics and Price Forecasting; Chapter 9, Mergers and Acquisitions; Chapter 10, Marketing Planning in the Chemical Industry; Chapter 11, International Marketing Research; Chapter 12, Participation in Planning and Decision Making; Chapter 13, The Impact of Vertical Integration; Chapter 14, Chemical Marketing Research and the Computer; and Chapter 15, New Horizons for Marketing Research. A good Bibliography is included along with two appendixes. An effective index assists in selecting specific subject matter. Appendix A is concerned with report writing and the selected portions of this technique, if followed, cannot help but improve any written presentation. Appendix B provides statistical data useful in general presentations, showing chemicals in relation to all manufacturing.

In general the presentations are fortified by pertinent literature references without unnecessary cluttering of the text. One pertinent literature reference noted as missing was that on PERT (Program Evaluation Review Technique) since insufficient information was furnished for its use. The book contains many references to sources for information in addition to the full chapter on this subject. Quite pertinent to current events is the chapter concerning marketing research and the international market.

Almost without exception, any member of the American Oil Chemists' Society could benefit by studying the contents of this how-to-do-it marketing research reference. An attempt at classifying the chemical industry immediately is faced with the fact that it consists of as many as 40 different businesses, into one or more of which very many of our membership fits. The casual or background reader can readily find application to related use, while the marketing researcher either can use the presentation as a checklist, or if new to the field, can apply the essentially step-wise presentation for needed background. The importance of marketing research to corporate growth is well documented.

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"RHEOLOGY THEORY AND APPLICATION" by Frederick R. Eirich (Academic Press, 522 p., 1967, $24.00).

The series "Rheology Theory and Applications" summarizes experimental and theoretical knowledge in the field of rheology, the science of flow and deformation as related to physical and chemical material properties. It covers the areas between physical chemistry on the one hand and hydrodynamics and continuum mechanics on the other. The material is presented in the form of independent chapters by leading authorities: Viscosity and Molecular Structure by A. Bondi; The Microrheology of Dispersions by H. L. Goldsmith and S. G. Mason; High-Shear Viscometry by Arie Ram; Rheological Aspects of the Mixing of Plastics Compounds by James T. Bergin; Rheology of Liquid Crystals by Roger S. Porter and Julian F. Johnson; Nonlinear Steady Flow Behavior by Hershel Markovitz; Some Quantitative Considerations about Spinning by H. F. Mark; Thixotropy and Dilatancy by Walter H. Bauer and Edward A. Collins; Rheological Terminology by M. Reiner and G. W. Scott Blair.

The book is a condensed report on present-day knowledge of theoretical and experimental rheology that brings together in a single source accounts of recent advances in

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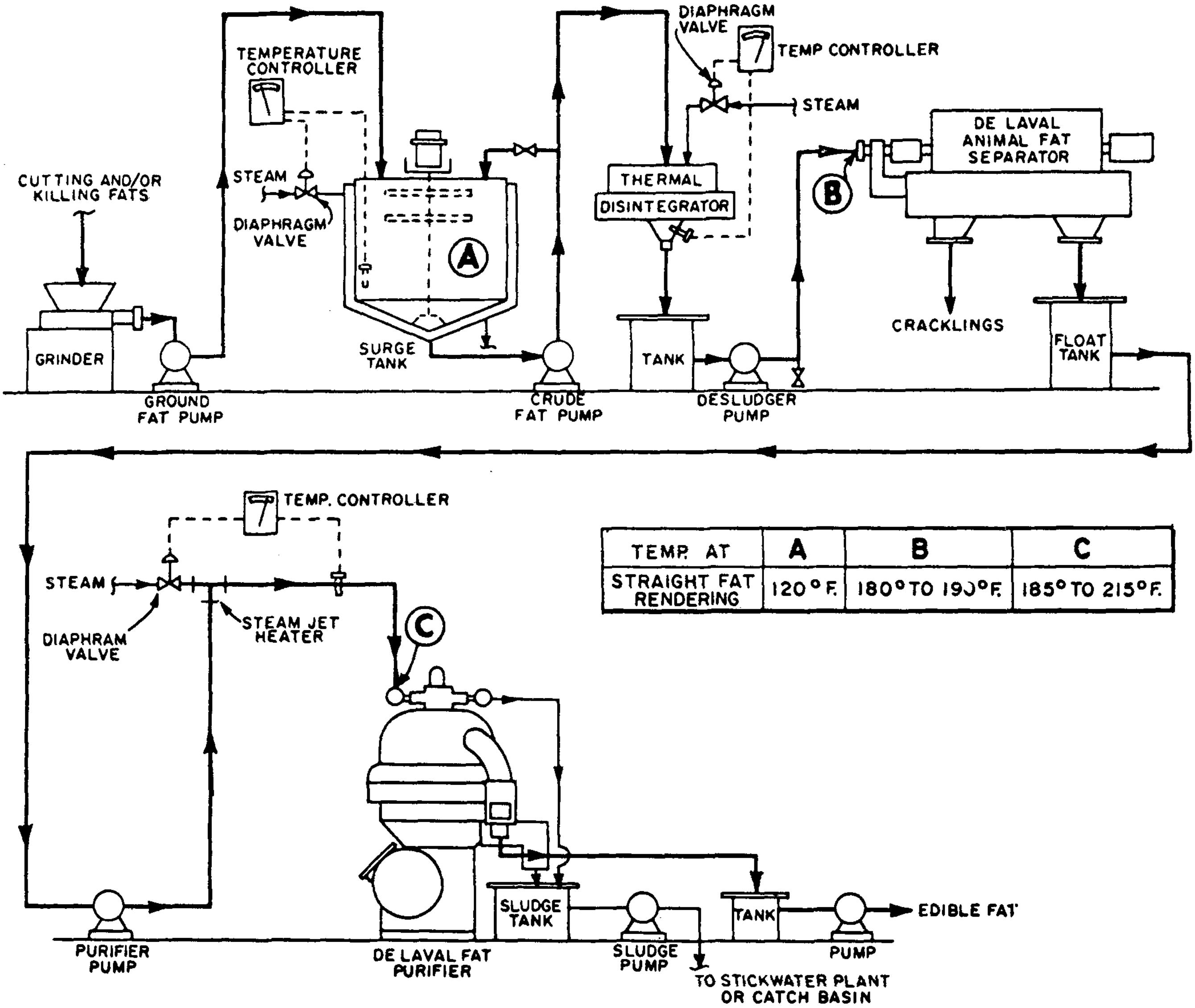
(Continued from page 424A)



TEMP. AT	A	B	C
STRAIGHT FAT RENDERING	120° F.	180° TO 190° F.	185° TO 215° F.

Fig. 5. Schematic presentation of the De Laval system.

continuous discharge of the fat and protein. Adjustments can easily be made to vary fat content of the edible protein in accordance with the customer's requirements. For straight rendering, an adjustment is selected to obtain protein with a minimum fat content, thereby increasing over-all fat yield.

The fat is further heated to 200F. At this point the fat discharges directly into the De Laval Animal Fat Purifier for removal of traces of fine protein and residual moisture. The purified fat, depending upon material source, has a prime bland flavor and is ready for immediate use without any further treatment. The tank water discharged from the purifier contains a small quantity of proteein with traces of fat and is easily disposed of.

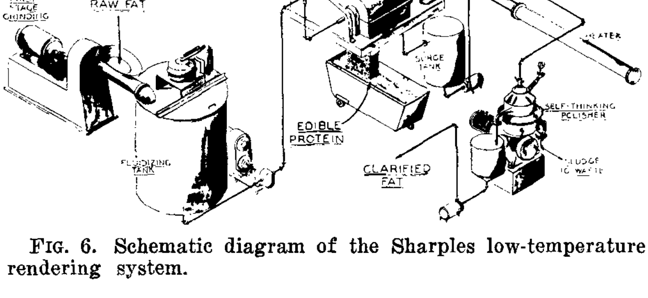


Fig. 6. Schematic diagram of the Sharples low-temperature rendering system.

If producers want to use their finished fat as an animal shortening, it is necessary to follow through with a slight bleaching and a texturing treatment. If the animal shortening is mixed with a certain percentage of vegetable oil, it can be sold as shortening.

Some of the claims made for the process follow. The only tank in the system is the enclosed surge tank with a holding time of less than 10 minutes. The Thermal Disintegrator shreds the tissue to free the fat; the tissue is thus conditioned for ideal subsequent separation of the fat from the protein. The De Laval Desludger is designed to remove protein from the fat instantaneously under sanitary conditions. After protein separation, the fat is purified in an enclosed system to prevent oxidation and emulsification of the fat.

The De Laval Animal Fat Purifier is designed to handle animal fat at maximum capacity with minimum loss of fat. There is no disposal problem. The amount of tank water is small and negligible in fat content, consequently it can be disposed of without restriction. Plant operation is extremely flexible, and only simple adjustments are re-

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42nd Fall Meeting Close at Hand

• *Complete Technical Program Begins on Page 473A*

Becker and Marshack Organizers of Symposium on Processing

K. W. Becker

E. I. Marshack

A symposium covering the recent developments in processing will be presented at the 1968 Fall Meeting of AOCS in New York, Oct. 20–23, 1968. This symposium is being organized through the combined efforts of K. W. Becker of Blaw-Knox Co. and E. I. Marshack of Eugene Marshack Assoc. The former is responsible for the presentation of new developments in Europe and the latter for those in the United States.

The following papers will be presented in this symposium:

1. J. A. DeSmet, Extraction DeSmet S. A., Antwerp, Belgium. Winterization of Vegetable Oils.
2. H. J. Schmidt, Lurgi Gesellschaft fur Warme und Chemotechnik, Frankfurt, Germany. Selective Hydrogenation of Soybean Oil.
3. Ben Braae, Alfa Laval A. B., Tumba, Sweden. Alfa Laval's New Fractionation Process.
4. J. F. Sullivan, Sutton, Steele & Steele, Inc. Dallas, Texas. Principles and Practice in Soybean Dehulling and Meal Concentration.
5. D. W. Johnson and E. A. Buelens, Crest Products, Inc., Park Ridge, Ill. Protein Production for Edible Use.

In addition, a paper on the Processing of Fish Oils will be presented by Ragnar Ohlson of A. B. Karlshamns Oljefabriker, Sweden, in the Marine Oil Symposium which has been organized by M. E. Stansby of the Bureau of Commercial Fisheries.

Gerhard Maerker

For the interest of chemists, a symposium on Cyclic Derivatives has been organized by Gerhard Maerker of the Eastern Utilization Research and Development Division of USDA. The chemistry of cyclopentenyl fatty acids, epoxides and ozonides will be discussed by F. D. Gunstone of the University of St. Andrews, England, H. K. Mangold and O. S. Privett of Hormel Institute, Daniel Swern of Temple University and J. S. Showell of National Science Foundation.

Spare Moments Will Be Rare Moments for Wives at the 42nd Fall Meeting

Aside from shopping on Fifth Avenue or attending theaters on Broadway, there are myriad interesting things for your wife to do in New York City.

The New York City Opera Company will be in season at the New York State Theater in Lincoln Center; the top ticket price for these operas is $5.95 (it is a good idea to write ahead for tickets since at this price they go quickly). Also, the Philharmonic Symphony Orchestra will be holding concerts at Lincoln Center in October, their main season.

Most people have heard about the Guggenheim Museum, the Metropolitan Museum of Art and the Museum of Modern Art, but there are also the Chinese Museum on Mott Street (a good chance to have a Chinese meal), the Whitney Museum of American Art, the Jumel Mansion, the Museum of the American Indian, the Museum of the City of New York which is particularly interesting as it traces the development of the city from the time of Peter Minuet to the present.

There is also Greenwich Village, a town in itself, with unusual stores and restaurants, and unusual people.

Restaurants of international cuisine are too numerous to mention. A copy of *Cue* magazine would be a good guide to addresses and price ranges.

The drive to Bear Mountain at this time of the year is simply magnificent, and going a little farther, West Point is always worth a visit.

Your wife will be delighted to have the opportunity to visit this fascinating city. The ladies' hospitality desk will be happy to guide her on any of the above, or help her with her own plans.

Dr. Chang Organizes Program for the 1968 Fall Meeting of the AOCS

Dr. S. S. Chang, who has conducted research on the flavor chemistry of potato chip for PCII during the past six years, is the Program Chairman for the 1968 Fall Meeting of the AOCS which is going to be held on October 20 to 23, at the Statler Hilton Hotel in New York City. Dr. Chang has organized a program which will have 150 papers being presented in five concurrent sessions during the meeting. Besides speakers from the United States and Canada, the program will also feature speakers from England, France, Italy, Germany, Belgium, Sweden, Switzerland, Denmark, Austria, Egypt and Japan.

The meeting will have the following symposia: New developments in the processing of fats and oils both in the United States and in European countries; Plant safety; Pollution and waste treatment; High molecular weight lipids including the decomposition products produced during the use of fats and oils in deep fat frying; Oxidation and flavor stability of fats and oils; Surfactants, detergent additives and hard surface detergents; Cyclic derivatives of fatty acids; Organ specific triglycerides; Adipose tissue; Lipids in disease; Drying oil; and Marine oil.

There will also be sessions in analytical methods, particularly gas chromatography and spectrophotometry, fats, oils, fatty acids, reactions, biochemistry and nutrition of lipids.

Dr. Chang is now serving as Secretary of the AOCS. He is also an Associate Editor of *JAOCS*.

SYMPOSIUM: SAFETY IN SOLVENT EXTRACTION
conducted by The American Oil Chemists' Society at its 41st Fall Meeting, Chicago, Illinois

N. H. WITTE, Program Chairman

History of the AOCS Technical Safety and Engineering Committee

N. H. WITTE, Central Soya Co. Inc., Fort Wayne, Indiana 46802

Abstract

A general review is presented of the activities of the Technical Safety & Engineering Committee of the AOCS from the time of its formation in 1956 to the present. The first major emphasis of the Committee's activity was on Safety in Oil and Fat Solvent Extraction Plants. The Committee cooperated with the National Fire Protection Association in the writing of the NFPA "Standard for Solvent Extraction Plants (NFPA No. 56)." In more recent years the Committee has broadened its interests to include studies and symposia on air and water pollution as it affects the oil and fat industry.

Introduction

THE ORIGIN OF THE Technical Safety & Engineering Committee goes back to a small informal discussion which took place during the 1953 AOCS Fall Meeting. The principal emphasis for this meeting arose from a common interest in a proposed "Schedule for Measuring and Rating the Hazards of Solvent Extraction Plants" being proposed by the Texas Insurance Advisory Association. Informal discussions continued with increasing interest at each subsequent AOCS meeting until the Spring meeting in 1956 (Houston) where the first formal meeting took place.

At this meeting, Miles Woodworth, Secretary of the Flammable Liquids Committee of the National Fire Protection Association, told the group that the NFPA had formed a sectional committee to develop a National Standard for Solvent Extraction Plants and that a draft was currently being prepared. He invited the AOCS, as a Society, to appoint a representative to serve on this committee.

The great interest shown during this 1956 meeting led to a group recommendation that the AOCS should appoint a permanent Technical Safety Committee and this recommendation was approved by the governing board. A. E. McGee was appointed the first permanent chairman.

At its first regular meeting in the fall of 1956 (Chicago), the authorized Committee began the practice of having a group of formal papers presented by various authorities to serve as focal points for the discussion. At this meeting, McGee also reported on his first meeting with the NFPA sectional committee. The Technical Safety Committee agreed that it would make an intensive study of the proposed Standard.

At subsequent meetings in 1957 and 1958, the NFPA

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Standard received much attention. A special study committee held meetings in January and December of 1958 to draft suggested revisions which were approved by the Technical Safety Committee and forwarded through its representative to the NFPA.

As a result of the Technical Safety Committee interest, the NFPA Standard No. 36 (tentative) underwent several revisions incorporating worthwhile changes. In 1959, the NFPA adopted the Standard as permanent but the Technical Safety Committee continued to make recommendations for additional improvements until the Fall of 1961 when the study on this specific Standard was formally concluded.

Although much of the activity in these early years centered around the NFPA Standard, the Technical Safety Committee also had groups working on a number of other significant projects such as: Laboratory Safety, Determination of Residual Solvent in Meal, Safety Rules for Extraction Plants, Reports of Fires and Explosions, Spark-Proof Tools.

Each of these projects involved considerable work on the part of the Committee and served the purpose of bringing all members up to date on the state of the art and making them aware of the problems still to be resolved.

At the Spring meeting of 1960 in Dallas, the Technical Safety Committee, at the direction of the governing board of the Society, enlarged its area of interest to include educational activities relating to the increasing activity of the FDA in the industry's plants. The Fall 1960 meeting contained the first of a series of papers relating to housekeeping and sanitation for plants in the fats and oil industry.

By 1962 the activities of the Committee had broadened to a point where the original name (Technical Safety Committee) no longer seemed appropriate. The name was changed to Technical Safety and Engineering Committee. The Committee broadened its activity to include formal papers and discussions on general plant engineering topics relating to the entire fats and oil industry. However, the interest in safety was not diminished as evidenced by a Committee study on the hazards of ethyl ether, related particularly to its use in the new neutral oil determination which was being adopted by the soybean processing industry.

In 1964 the Committee began to interest itself in water and air pollution problems. Every meeting since then has featured one or more speakers in this area. One of the topics receiving considerable attention was Rule 66 of the Los Angeles air pollution control district which relates to solvent emissions.

The present broad scope of this Committee's activities is outlined by the following definition of scope from the 1968 Directory:

"Scope—To promote the Safety and Engineering in the Processing of the Vegetable oils and related industries; to work with any approved agency in the development of specifications for the Industry in regard to Safety and related subjects and conduct seminars to discuss and disseminate this information."

Looking back over the past years at the activities of the TSEC, one must conclude that it has served a useful purpose in providing a focal point for many people with plant interests and has filled a need for education and action in areas not previously served by the Society. With leadership and high interest on the part of its segment of the AOCS population, it can continue to do this in the future.

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Hazards in Solvent Extraction as Seen from a Property Insurance Point of View

W. C. MEINHARDT, Factory Mutual Engineering Corporation, Chicago, Ill. 60606

Abstract

A review of the processing steps involved in oilseed processing is presented with particular emphasis on the fire and explosion hazards involved. Special emphasis is placed on flammable liquid handling and the "Seven Safeguards for Safe Use of Such Materials."

It is emphasized that maintaining the safest plant possible is a common goal of the operating personnel, their management, and the insurance industry. Consultation with the insurance carrier before, during, and after construction of a solvent extraction plant will help insure that the best thinking of operating personnel and loss prevention specialists is utilized to provide the safest plant.

Review

VEGETABLE OIL AND BY-PRODUCTS are produced from vegetable materials by processes that present fire and explosion hazards.

A convenient means of reviewing the hazards involved and suggested safeguards is to correlate this presentation with a description of the actual flow of materials through a typical soybean plant. Though basic principles will remain unchanged, it is readily acknowledged that specific details will vary from plant to plant due to numerous variables.

Initial operations commence when beans are delivered to the plant. They are dumped from truck or car and conveyed, usually by belts, to elevators from which they are subsequently dumped into bins. This process principally involves two hazardous aspects: 1) the creation of an explosive dust condition, and 2) the spontaneous heating of those beans in storage which have an excessively high moisture content.

Recommended protection from the dust hazard is the provision of a dust-collecting system at all points where dust is liberated, including the bean dumps, conveyor transfer points, elevator legs and heads, bean filling chutes, cleaning screens, etc. Dust collectors of the all-metal type should be located outside of buildings or at least equipped with large explosion vents terminating out-of-doors.

Dust leakage from both cleaning equipment and conveying systems must be minimal and should be accomplished by constant surveillance and immediate response when leaks occur. Dust-tight enclosures, operated at slight vacuum are most effective.

Heat-sensitive devices are used in storage facilities to signify temperature increases. Another danger signal is the detection of a musty odor by plant personnel during scheduled weekly inspections of these storage areas and equipment.

Electrical equipment, including wiring, lights, as well as frequently over-looked items such as clocks, telephones, soft-drink cooling and dispensing machines, etc., should be suitable for Class II, Group G occupancies as defined in the National Electric Code. All conveyors, mills and other equipment in which materials are handled should be electrically grounded.

Elimination of other possible ignition sources is achieved through the provision of magnetic separators at car and truck dump hoppers or conveyors, and on conveyors ahead of milling or grinding operations to remove tramp metal.

Standpipes with hose connections at each operating level should be provided in elevator houses, conveyor structures, and cleaning and drying areas. Equipment should include 1½-in. woven-jacketed, rubber-lined hose with combination spray nozzles. Provide 2½-in. connections with hose and nozzles at silo-top level and in the basement. It is likely that some of these areas will be unheated; this requires a dry standpipe and equipping each hose station with a remote-control operating device.

The beans are conveyed to the processing equipment from the storage bins. The solvent extraction process may be considered as consisting of three parts: the preparation of the beans, extraction of oil from the beans and reclamation of the solvent from the meal and oil.

Beans are prepared by passing them through a cracking mill where each bean is broken into particles; there are then steamed and flaked to break down the cellular structure and expose the oil cells to subsequent solvent action. No significant fire or explosion hazards are present in the bean preparation phase.

After preparation, the bean flakes are transferred to the extractor through which they pass by mechanical means against the counterflow of a hydrocarbon solvent, with hexane being most generally used. Oil is removed from the flake by the solvent through washing and diffusion. The system now divides into liquid and solid phases; the oil is extracted and the solvent recovered from the liquid phase. In the solid phase, solvent is also recovered and the spent meal is finally cooled, stored and bagged.

After the beans are prepared and are conveyed to the extractor, the dangerous aspects of a flammable liquid are ever present. We are faced with the problem of handling relatively large quantities of a low flash point solvent as safely as we can and of providing necessary protection in the event of an accident. The hazard of solvent extraction is therefore the presence of flammable liquids.

I have been building up to the gist of my presentation which is: solvent extraction is flammable liquid handling! Henceforth I intend to dwell primarily upon safeguards for flammable liquids, which will develop identical safeguards for a solvent extraction operation.

The seven Safeguards for Flammable Liquids are: 1) Isolate the hazard. 2) Confine the liquid. 3) Provide ventilation. 4) Install explosion vents. 5) Eliminate ignition sources. 6) Educate employees. 7) Provide fire protection.

The Protected Plant

With these fundamentals in mind, we can begin to prescribe the physical layout of a well-protected solvent extraction (S-X) plant.

1) Isolate the Hazard

The extraction process should be located at least 100 ft from important buildings and other equipment. The extraction equipment should be located preferably in the open, with a minimum of enclosing structure. The bean preparation equipment should be in a structure separate from the extraction equipment or at least on the opposite side of a substantial fire wall. Solvent storage tanks should be buried, or diked and separated from the extraction building by distances depending upon the size of the tanks. By so locating the process we have divided the building-tank-equipment complex into three individual parts, and an accident in one should not cause material damage to the other two.

2) Confine the Liquid

Design and maintain the equipment to eliminate leakage. In addition to the hazard introduced, such leakage will obviously increase the cost of operations. Provide emergency drainage facilities for the extraction area so that escaping liquid will be conducted away from other buildings.

3) Provide Ventilation

Vapors from flammable liquids will explode when mixed with air in certain definite proportions. Explosive limits of hexane when mixed with air are from 1.2 to 7.5% by volume.

Continuous mechanical positive exhaust ventilation should be provided in extraction areas, pump rooms and other areas where flammable vapors are unconfined, on the basis of 1 cfm per square foot of floor area. Since vapors of hexane are about three times as heavy as air leaks or spills will result in the most dense concentration near floor level, so the exhaust fans should be arranged to take suction near floor level and discharge out-of-doors. Similarly, the extraction building should be built at or above grade with no basement or pipe trenches.

One hazard of a solvent extraction plant is different from that of usual flammable liquid occupancies. Since the solvent vapor concentration within the unit is above the upper limit of the explosive range we are safe from explosions within the equipment. To insure this condition, the equipment should be arranged to operate at a slight pressure.

The greatest hazard in the S-X plant occurs when the unit is taken off stream for repair or cleaning. If this closed system were exposed to air the unit would necessarily pass through the explosive range. In this situation certain precautions and safeguards must be taken. Before the equipment is opened, it should be purged with an inert atmosphere. If the unit is free of flakes, less inert gas will be needed to achieve a safe condition than if flakes are present. Also, during start-up, an inert gas purge should be provided to preclude passage through the explosive range.

4) Install Explosion Vents

Despite all precautions, explosions in S-X equipment have resulted. A catastrophic loss can be minimized by locating extraction equipment in the open or by using light, noncombustible construction such as sheet metal or corrugated asbestos on steel framing for maximum explosion venting. This construction is suggested since both siding and roof may be fastened to withstand wind forces but to release at explosive pressures. Though roof and siding may be blown from the building, the structural steel should not be severely damaged. Fireproof load-bearing steel members so a 2-hr resistance rating is attained.

5) Eliminate Ignition Sources

Since one out of every five industrial fires is of electrical origin, a major concern of the S-X plant is the electrical equipment. All electrical installations should be in accordance with the National Electric Code for Class I, Group D occupancies. Steelwork and all equipment which handles flammable liquid should be grounded. Belt drives and gasoline-engine-driven industrial trucks should be prohibited. Only absolutely necessary welding operations should be conducted and then only after a check and recheck of all explosive conditions. A fence is desirable around the extraction area to better control smoking and the entry of unauthorized personnel.

6) Educate Employees

This aspect is vital. As expressed in the foreword of the new NFPA Standard 36, the operator of a solvent extraction plant must establish and maintain fire safety esprit de corps among a small number of employees as opposed to relying on established customs in large scale operations. Employees must be made thoroughly familar with the hazards and necessary precautions and follow safe practices. Instructions should be posted for the safe operation of processes. Operators should not even occasionally deviate from instructions and thereby come to accept dangerous conditions as a matter of course.

Operators must not tamper with the equipment or make protective devices inoperative. They should be trained to notice and report defects for immediate correction.

7) Provide Fire Protection

Install automatic sprinkler protection on a wet-pipe or open-head deluge system over extraction equipment and throughout buildings housing such equipment. Sprinklers are also needed at intermediate levels of extraction equipment and under decks, tanks or other shielded points. Strong water supplies to these systems are vital.

It is not expected that such sprinklers will extinguish a flammable liquid fire within the building but they will minimize structural and equipment damage by keeping the structure as cool as possible.

In addition to sprinklers, yard hydrants with hose and spray nozzles should be provided as well as appropriate extinguishers throughout the building.

Under the last general subheading in the S-X plant process is, the solid phase during which extracted meal is finally stored and bagged. Hazards here consist of a dust condition for which earlier mentioned safeguards are applicable and combustible occupancies such as paper bags, cartons, skids, etc., for which automatic sprinkler protection is needed.

This discussion has only highlighted the hazards and protection of the solvent extraction industry. There are many other desirable protection features such as remote control emergency shutdown features and solvent salvage dumping arrangement, which operators no doubt employ in their respective plants.

Regardless of who your insurance carrier is, it is suggested that he be consulted before, during and after construction of a solvent extraction plant since his specific knowledge in loss prevention areas may well augment your specific knowledge in extraction plants. Certainly the goal of maintaining the safest plant possible is communal to managements, employees, and those in the insurance industry.

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Methods and Results of Purging Extractors

C. L. KINGSBAKER, Blaw-Knox Company, Chemical Plants Division, Pittsburgh, Pennsylvania 15222

Abstract

Nearly every extractor that has been put into operation has been purged many times. The extractor is purged when emptied for routine inspection; it is purged for welding; and it is purged under full load to correct for a failure in the machinery, which in most instances will be difficult. In the vegetable oil industry, there are three methods of extractor purging: purging with air, purging with steam and purging with inert gas. The most common method of purging is with air.

Large sized blowers are used to quickly empty the extractor of solvent vapors and to facilitate entry.

Purging extractors for welding requires thoroughness and careful isolation from the rest of the plant.

Every company has its own purging standards and procedures. There are some situations which arise that may not be covered by your company's rules. It is at these times that imagination, resourcefulness and caution replace standard procedures and safety practices.

Introduction

In October 1967 I visited a plant in Japan whose "Rotocel" had been shut down during its initial operation. The plant was processing quenched polyethylene, using hexane as a solvent. There was a cooling water failure and the polyethylene entering the "Rotocel" was not quenched. This resulted in liquid polyethylene entering the "Rotocel" and solidifying in it. After the feed was cut off an unsuccessful attempt was made to empty the "Rotocel." Apparently a large piece of solidified polyethylene wedged in the feeder underneath the "Rotocel" causing a shear pin to break in the feeder. The operators were unable to start the feeder, and, as a result, the "Rotocel" could not be unloaded. To further complicate matters the owner had deleted the purge blower in favor of a nitrogen purge system. When I arrived at the plant the owner had been pumping 175F water through the system for 3 days trying to boil off the hexane in the "Rotocel." I am sure they could have continued for another 3 weeks without removing all of the hexane. This leads directly into the subject of purging extractors which seems quite elementary but, under unfortunate conditions such as above, can be very difficult and serious. It is a subject that is often unpleasant but must be faced by all processors. When a situation as outlined is encountered, the final solution is obtained by entering the extractor, correcting the trouble and then emptying it. During this time a purge blower is required.

Nearly every extractor that has been put into operation has been purged many times. The extractor is purged when emptied for routine inspection; it is purged for welding; and it is purged under full load to correct for a failure in the machinery. In the vegetable oil industry, there are three methods of extractor purging: purging with air, purging with steam and purging with inert gas. The most common method of purging is with air. I did not include purging with water as I am sure all of you would shudder at the thought of pumping hot water through an extractor full of soybean flakes.

In the first solvent extraction plants, the vent blower of the plant also served as the purge blower. This blower was normally slightly oversized for the normal operating duty of venting the plant, so it could be used to vent or purge the extractor. The volume pulled by this blower was usually so small that it took several days to sweep all the hexane vapors out of the extractor. As the art progressed, a separate purge blower was installed on the extractor whose sole function was to quickly purge the extractor for quick entry. The blower was connected to the extractor only during purging. The blower was sized to change the volume of vapor in the extractor once every 2½ minutes. Some companies now have a standard to change the volume once a minute. This capacity, in my opinion, is excessive. The blower supplied for this purpose is an inexpensive centrifugal blower mounted at the bottom of the extractor that can be connected to the extractor very quickly and put into service. The advantage of using a large blower is to permit a man to get inside the extractor within 30 to 60 minutes after a breakdown to investigate the problem if the extractor fails under load. If the extractor is empty, the extractor can be quickly purged for routine inspection.

Purging an extractor for welding is always a distasteful task but not necessarily as difficult as it sounds. It is time-consuming and usually requires about two days' preparation. The following is the procedure normally used when welding is necessary:

1) All vessels containing hexane or miscella must be emptied and filled with water.

2) The lines connecting the extraction plant and underground storage tanks must be blanked off and all lines containing hexane or miscella emptied and purged.

3) The extractor must be emptied, air purged and cleaned of any flakes remaining in the bottom.

4) Stage pump suction and discharge lines must be drained and filled with water.

5) The discharge hopper must be filled with water.

6) The flake inlet spout to the extractor and solvent inlet line must be blanked off.

Now the extractor is isolated from the rest of the system.

7) Some processors now turn off the purge blower and steam out the extractor for eight hours.

8) The purge blower is again turned on and the extractor cooled.

9) The entire plant and the extractor must be carefully checked, especially in low points, for an explosive mixture, using a special meter.

10) When negative readings are obtained welding can start. The purge blower is left on while welding. Psychologically, it is wise to have the superintendent first light the torch. This gives the welder self-confidence that the purging sequence has been properly done. I had this experience many years ago. One of our first "Rotocels" had to have a new plate support added. The customer was to do the welding. They simply told me to inform them when I was ready and they would give me the honor of lighting the torch inside the "Rotocel." I did a most careful purging job since my safety was at stake.

The explosive limit of hexane and air must be passed through each time an extractor is started. This is like passing through the sound barrier. The range is 1.3% to 7% by volume of hexane in air. Most processors in the world add hot hexane liquid and vapor to the extractor and displace the lighter air inside with heavier hexane. When a temperature of about 100F is obtained at the top of the extractor, all of the air is displaced and the extractor is ready to start. A few processors displace all of the air first with an inert gas and then introduce hexane. In this way, passing through an explosive range of hexane is avoided.

There is some concern that static electricity could occur in the extractor, when an explosive mixture is present, and cause an explosion. The static electricity would be created by liquid hexane falling from the top of the extractor to the bottom. I doubt that such a condition has ever occurred. Of course there could always be a first time but since the tall vertical basket extractor was built in Germany some 40 years ago, I know of no accident on record caused by static electricity in start-up. I am sure that in the many thousands of start-ups if there was such a chance of an explosion it would have occurred during that time. The Blaw-Knox system of heating a "Rotocel" eliminates any possibility of static electricity since the "Rotocel" is heated at first with hot hexane vapors from the distillation system before stage pumps are turned on.

Although inert gas may be used effectively to purge for start-up, its use in shutting down is a different story. If the extractor is empty of all solvent and flakes, purging with inert gas would take a very long time to remove all the solvent vapors. Even then, until the extractor is entered and all flakes and miscella are removed by hand there continues to be a source of hexane vapors. Of course, when the extractor is opened, air will enter and there is a chance of creating an explosive mixture. It is therefore my opinion that the use of inert gas for purging is ineffective.

The most serious problem in the operation of a plant is to have the extractor fail under load when there is no way of emptying it. To correct this problem, the extractor is allowed to cool, access covers are removed and then the extractor is purged with air. A man with an air mask must enter the extractor, locate the cause of trouble and repair it. During this operation, air is entering the extractor and mixing with hexane vapors. There is always the possibility that an explosive mixture will be present. All work must be done most carefully to avoid producing a spark. I have been in this situation several times and it is a most nerve-racking experience. After the trouble is corrected, the purge blower is turned off, the covers put on, the air displaced with hexane and the extractor restarted. The use of inert gas in this type of situation in my opinion would not be feasible. I do think that this subject is one that we should discuss later in this meeting.

As the result of an experience recently with a smoldering fire in an extractor and in the en masse elevator taking flakes away from the extractor Blaw-Knox now provides permanent steam connections to each.

I talked with insurance company engineers about using this system rather than an inert gas system. Steam is piped into the extractor above the liquid level and the valve in this steam line is located outside extraction area enclosed in a glass box marked "For Emergency Use Only." Double block valves with a bleeder are used to protect against admitting steam into the extractor during operation. This is a simple and inexpensive system for extinguishing a smoldering fire inside the extractor. I favor steam because there is always a large quantity available in an extraction plant and it is inexpensive, highly effective and more reliable than an inert gas system. The latter may be difficult to start and usually has insufficient capacity to fully saturate the atmosphere inside a large extractor, especially if access covers have been removed. Also, with a tank of liquid CO_2 or nitrogen there is always a possibility of losing the entire charge because of mechanical problems.

Purging of extractors has been a necessary evil to the industry since the first extractor. Every company has its own purging standards and procedures. There are some situations which arise that may not be covered by your company's rules. It is at these times that imagination, resourcefulness and caution replace standard procedures and safety practices.

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Some Specific Extraction Plant Safety Problems and Some Suggestions for Control

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Abstract

This paper concerns some practical operating problems and solutions in the solvent extraction of soybeans, and mention is made of building construction and automatic deluge systems, together with some observations on the human aspect of occurrence of accidents. A discussion is included on the use of nonflammable solvents and the desirability of finding and employing a suitable nonflammable solvent for the industry.

Introduction

THE ARCHER-DANIELS-MIDLAND COMPANY soybean processing complex consists of seven plants at seven specific plant sites in the United States. One of these plants is now under construction in Lincoln, Nebraska. Of the remaining six plants, only three were built under the specific direction of Archer-Daniels-Midland Company personnel. The remaining three plants were either purchased or leased from other owners; thus, we are in the position of being able to evaluate a multitude of safety precaution measures, as well as operating problems, occasioned by a number of different personnel who constructed the individual plants. I believe the operating knowledge we have picked up in the last five years has been valuable to us as a group, because of the varying background of the plants that we have put together in our complex. We share with you here some of the observations that have grown out of these operating experiences.

Cooling Water Pump Problems

We have had two water pump failures at different plant locations, which immediately put the plants under pressure and caused some tense moments, but no damage was suffered. Our solution to the pump failures was to install flow switches in our cooling water lines. Cessation of water flow automatically cuts out the electric power to the solvent pumps, the solvent distillation system, and the steam boiler. The plants in which the above-mentioned failures occurred did not have high water tanks. Our plants with high water tanks are relatively unaffected for several minutes in case of a pump failure, during which time the operator is able to find the cause and take corrective action.

Mineral Absorption System

In one of our locations, we have two plants with a connecting common mineral oil absorption system. This is unsatisfactory because a sudden surge of pressure in one of the plants must be vented through a long vent pipe, which may allow escape of vapors to the plant atmosphere. We are taking corrective action on this unit at present, and all of our individual plants will be served by its individual mineral oil absorption system.

Plugged Miscella Lines

Some of our problems at plants that were started up by ADM personnel after leasing, or purchasing, centered around the plugging of miscella lines with solvent and flakes. This necessitated dismantling of pipeline systems and a consequent spilling of miscella in the extraction area. This is a very dangerous practice and we go to unusual lengths to prevent the necessity of having to dismantle any piping filled with solvent. Our solution to this problem was to pipe from nearby miscella stage pumping lines into both the suction and discharge side of the pumps that are most likely to fail. Thus, we have found that by using neighboring pumps to flush plugged pipe lines, we are able to avoid dismantling the piping system. It may tend to disrupt our extraction procedures for a period, but this is much to be desired over attempting to unplug solvent lines.

Building Construction

We have found that building construction is an important contributing factor to overall plant safety. One of our plants has roll-up curtain doors at floor level in each bay. During the summer, these doors contribute to the comfort and safety of those in the building. In the wintertime, in case of solvent loss, the doors can be opened immediately to clear the building of solvent vapors. We have found that parapet walls on buildings with flat roofs are a hazard. During one shutdown, meal cooler fans discharged hexane vapor into this open parapet area on top of the building. This vapor was not disseminated and upon plant start-up, a flash occurred that did no damage but was hard on the operating personnel's nerves. Our recommendation for future plants is to locate as much machinery as possible outside, except in cases where severe winters make this impossible. We also feel that parapet walls should be eliminated, and where possible, sloping roofs are recommended.

Occurrence of Accidents

It is our observation concerning plant flash fires in the industry, that the majority of these instances occur between 3 and 6 AM when operating personnel are at their lowest peak of efficiency. We have under consideration a proposal not to attempt to restart plants that have broken down on the third shift after 3 AM. We are considering bringing in the day shift personnel early to restart the plant. My own observation is that the most dangerous period of any operating day is between 5:00 and 5:30 AM each morning. Another observation along the same line has to do with the euphoria that seems to blanket the thinking of plant personnel when exposed to slight inhalation of solvent vapors. We have noticed on several occasions that people just do not think, or react, correctly when exposed to hexane vapors. We think this is due either to the inhalation of vapors, or the atmosphere of the midnight shift. The early morning is not conducive to clear and steady thinking. Our ancestors used the night for resting, but our modern industry requires that plants be operated 24 hours a day to be efficient, both economically and with respect to maximum yields, and many people just cannot respond to this modern demand.

Automatic Deluge System

One safety feature that I am enthusiastic about is an automatic deluge system that is triggered by any unusual temperature rise. We have smoke rings on the ceilings of two of our extraction plants, which are mute testimony to the efficiency of these deluge systems. In both cases, the flash fires were extinguished immediately with no equipment damage. I am an extremely enthusiastic champion of deluge systems and feel that in my experience and observations they are absolutely essential to the safety and well-being of both the personnel and the plants. Of all the particular safety items, it is my firm opinion that deluge systems are the most important single factor in any safe plant.

Nonflammable Solvent

A point that has been discussed for years in the solvent extraction industry is the use of nonflammable solvents for extraction operations. This point has been under consideration since the early twentieth century when solvent extraction began to be developed and numerous fires were experienced. In the late 1940's there was much discussion about the commercial use of trichlorethylene. Several small plants were operating on trichlorethylene and plans for several larger ones were on the drawing boards when a cattle poisoning incident recurred. This was a repeat of a cattle poisoning experience which dated back as far as 1915 in England. Since 1950, the trichlorethylene usage has been shelved. Apparently, trichlorethylene decomposed and some of the chlorinated components of meal poisoned the cattle. Since 1950, very little has been said, written, or done, about employing the use of nonflammable solvents in our solvent extraction operations. Commercial solvent companies, with their vested interests in hexane production facilities, have exhibited very little creative thinking about better and nonflammable solvents. It does seem that this is a time to attempt to reawaken interest in the employment of a nonflammable solvent in our industry. It would appear that with the technological development we have experienced within the last two decades, a tailor-made solvent could be isolated, or synthesized, for specific use in the solvent extraction industry. Another suggestion is for us, as an industry, to learn how to live with the present known nonflammable solvents and attempt to correct the difficulties we have experienced previously with nonflammable solvents.

It is unfair to subject plant personnel to this continual hazard of operating hexane solvent extraction plants on a 24-hour basis. In this industry, low profit margins require pushing the plants as hard as possible to reduce costs. This pressure puts a great deal more responsibility on operating personnel and upon the plant managers responsible for plant safety. The widespread crop adaptation of soybeans requires that plants be built in isolated rural areas in contrast to huge chemical complexes of our brothers in chemical industry where elaborate safety programs can be adopted and plant precautionary procedures can be well detailed.

The solution to this problem of avoiding the use of an inflammable solvent such as hexane appears to lie within the jurisdiction of the NSPA. This is an association of processors, none of whom individually has the resources, or can afford the elaborate and costly investigation, necessary to adapt nonflammable solvents to the solvent extraction practices known today. If one company were to develop nonflammable solvents, there would be little, if any, commercial return other than for safety considerations for the industry at large. It would seem best for the NSPA to undertake the problem of investigating nonflammable solvents and assign it to a joint committee of representatives of each of the member firms. It could be the goal of this committee to study known solvents, or recommend a synthesized solvent and adapt it to plant practices by using it in some commercial plant in the United States under a joint venture. The optimum solvent besides being nonflammable, would have to be stable, cost about 20 cents per gallon, be easily recovered, and preferably, nonpoisonous. It would seem again, that this would be an opportunity for a private trade association to undertake research and effect a solution to this industry-wide problem without relying upon governmental funds, or resources, to solve the problem. In other words, I am urging that we, as an industry, make a concerted effort to find an acceptable nonflammable solvent that will replace commercial hexane.

Flame Depressants

The suggestion has been made that present solvents be modified by adding a flame depressant that would improve the flash and safety characteristics of commercial hexane. Here again, it could be the joint responsibility of an industry-wide committee to explore this problem and perhaps finance some research along this line.

I hope that these comments on the safety aspects of the extraction industry have helped you with some of your problems. I also hope that this discussion is able to awaken, or create, some new thoughts that can benefit the industry by reducing the hazards of a flammable solvent in our operations.

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Safety Problems in Operating Desolventizer-Toaster Machines

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Abstract

To operate a desolventizer-toaster (D-T) without the danger of explosion requires constant surveillance of several key points in the operation.

To eliminate the possibility of sparks or frictional heat or both, the use of the proper nonsparking tools and cleaning equipment is essential. The greatest hazard exists after a plant shutdown, when tools and other pieces of metal may be left in the equipment and then carried on into the D-T. All tools should have a place and be in place before the plant is started up. Along the same line, means of removing both ferrous and nonferrous tramp metal in the bean stream must be provided.

Before the machine is started up, adequate sparge steam should be injected into the lower sections to remove any traces of hexane that may have leaked in from the extractor. Maintaining an adequate seal between the extractor and D-T will reduce this hazard to a minimum and insure the proper flow of the hexane-steam mixture to the condenser system.

To insure that the proper precautions are being taken, start-up and shutdown procedures should be reviewed with the operators on a regularly scheduled basis.

Introduction

All of us are aware of the basic operating principles of a desolventizer toaster and are aware of the safety precautions that should be followed with its operation. Before going into any specifics, a review of the plant conditions preceding the recent explosion at our Decatur, Illinois, plant would be in order.

The plant had been on a scheduled shutdown for maintenance and repairs. Sunday evening, warm-up procedures were started in the extraction unit. The vessels, including the D-T, had steam applied and were warming up in preparation for a total start-up. Monday morning, at 7:00 AM, processing operations were begun, and by 10:00 AM flakes were run through the extractor and D-T. After approximately 1½ hr of operation, trouble was experienced with the D-T feed redler and the plant was shut down at 11:30 AM. A section of the divider plate had worn through and was carried to the bottom of the redler where it wedged in the unit. There were also six links of chain bent. After the plate was removed, repaired, and the links replaced, the redler was started at approximately 3:30 PM. After making several revolutions it was shut down as the operators were needed to make repairs elsewhere in the plant. After the repairs were made, operations were resumed in the extraction area at about 6:00 PM. There were three men in the extraction building at the time operations were resumed. During the start-up sequence, the redler between the extractor and D-T had moved approximately 4 to 6 feet when the explosion occurred.

One man looking up at the top of the D-T at the time of the explosion stated that there was a great deal of flying material but no visible flames. The three men ran immediately to an outside door and in passing through one man pulled the manual trip device on the deluge system. Afterwards all stated that they felt sure it was in operation already. No secondary explosions or fires developed.

Damage included rupture of the D-T dome lifting of the redler from the top of the D-T, and bulging of the top of the redler head. There was minor damage to the spout between the redler head and the D-T. Although the D-T heat exchanger was moved approximately ⅝ in., there was no noticeable damage to this unit. Damage to the building included 101 window panes broken, two sections of corrugated metal ripped off, and several sections blown loose. There was no evident damage or deformation to the building structure.

After the D-T was opened and inspected, a ⅜-in. metal rod about 18 in. in length was found in No. 1 kettle. This is the probable cause of the explosion. This rod had been used as a clean-up tool for the flaking roll feeders. No one knows how or when the rod got into the D-T. It was possibly left in the feeder after the clean-up operations. It did not show signs of wear; therefore, it must have entered the D-T recently. This rod possibly was carried around with the sweeps and could have caused a hot spot or sparks needed to cause ignition. At the time of start-up, the sparge steam had cracked open but evidently not enough time had elapsed for the sparge steam to purge the vessel. From this experience, the old policy of use of nonspark tools by both the operators and maintenance men is emphasized once again.

A total review of the hand tools available has been taken and adequate tool boards equipped with the proper nonsparking tools have either been restocked or everything brought back to its place. Numerous means have been used to clean the flaking roll feeders. We find that the best "tool" is a wooden paddle. The most hazardous conditions exist during the initial start-up. There are several means of preventing hexane vapors from entering the D-T before the material flow. The most common methods are a slide gate valve at the inlet of the D-T or a choke feed or both, depending upon the flakes for a seal. In addition, it is essential that an adequate amount of sparging steam is present in the D-T to force the hexane vapors up into the condenser system. As a result of our experience, we are now introducing live steam into the lower kettle as well as the top kettle to completely fill the unit with steam. Our operating procedures have been revised to make certain that ample time has elapsed between the introduction of the sparging steam and any of the process equipment ahead of the D-T is started.

Along with the problem of hand tools is the tramp metal purchased with the beans and the "in plant" metal. By "in plant" metal I mean elevator cup bolts and nuts, pieces of metal spout, conveyor lid clamps, etc. In addition to the usual spout type of magnet on the crack rolls, flake rolls, and hammer mills, we are using a high strength D-C magnet over the process stream as it is weighed in. This magnet is a good indicator of how well a preventative maintenance program is working in the elevator. For nonferrous metals several methods can be used. A specific gravity separator or an air dropout or both are the most common methods.

To determine whether all of the solvent is going out the top of the meal dryer to the condenser we use the nose test on the flakes; the explosion meter may also be used at the D-T discharge. We have found that the best method is to take a sample and close it up in an airtight container. After it has cooled to room temperature, the reading on the explosion meter may surprise you.

In summary, for a safe D-T operation: 1) Check the use of tools and cleaning equipment. 2) Provide adequate tramp metal removal. 3) Maintain the proper seals on the inlet. 4) Check the solvent removal efficiency. 5) Review the start up procedures with the operators. 6) Provide adequate sparge steam for purging.

A Review of Operating Rules Relating to Extraction Plant Safety

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Abstract

The speaker represents a company which operates two solvent extraction plants on soybeans and corn germ. This paper lists a composite set of safety rules formulated after canvassing companies representing sixty solvent extraction plants in the United States and abroad. The safety rules are offered as a guide to those plants without a formal set of rules.

Introduction

TO PROVIDE A COMPREHENSIVE cross-section of solvent plant safety rules existing today, a survey of major multi-plant companies was made. Fifteen companies operating 60 solvent plants were requested to provide a copy of their safety rules. Four of the companies did not reply and three did not have any formal rules spelled out on paper. The remaining eight companies representing 43 plants in the United States and Canada have all aided in the formulation of these safety rules.

It was interesting to note that two of the nation's major processors have formal printed safety rule booklets which are practically identical in both form and content. Both of these processors will note that many of the composite rules bear a distinct similarity to their own.

The purpose of this paper is to present to all interested persons the combined thinking of others in the solvent extraction industry on what a set of safety rules should contain. It should not be construed that the rules are all-inclusive or that every situation is covered. Each and every plant, even those within the same company, may well have a particular situation which requires special treatment. It is possible that the rules as set forth may be of assistance to those companies who do not have a formal guideline and have not had the opportunity to formulate a set of safety rules.

The ultimate goal of any set of safety rules is to prevent the loss of life and property. With very few exceptions, the costly casualties occurring in our industry can be traced back to the disregard of one or more basic safety rules.

This paper deals primarily with extraction plant safety; however, there are several rules listed which involve the preparation and milling areas of an integrated operation.

It is neither our purpose nor desire to publish these rules as a replacement for those companies who already have an existing formal set of safety rules in booklet form. I believe that few would argue that their particular set of rules is all encompassing and contains the last word in solvent plant safety.

Nor are these rules that I am about to cover all-encompassing. Each individual company, perhaps each individual plant, must have specific regulations in addition to those listed below. There are some rules listed which may be a direct contradiction to your company policy or even your union contract.

You may accept or reject all or any part of these rules as you see fit. We are in a highly competitive industry; yet, none of us hopes to gain a competitive advantage over another because of a plant misfortune. I did not receive a single refusal from those I contacted to cooperate in this survey. To me, this is indicative of the cooperation between all companies in our industry where safety is concerned.

The following are the composite safety rules for extraction plants:

Extraction Plant Safety Rules

RESPONSIBILITY:

The superintendent of the plant is responsible for the safe operation and maintenance of this unit. However, he may have to check with the general office before approving changes in procedure or equipment.

The superintendent will delegate authority and responsibility to key personnel, but all points not covered in this safety code must be approved by the superintendent.

GENERAL SAFETY RULES:

1. MATCHES, LIGHTERS, igniters or other sources of sparks or flame may not be carried into extraction areas. These items and cigarettes, cigars or pipes must be left in a place outside of the enclosed area.
2. Smoking is absolutely prohibited within the fenced area, around the solvent unloading point, or within any processing building. Steel lunch boxes are not permitted in extraction buildings.
3. FLASHLIGHTS: Only flashlights and battery powered lanterns approved by the Underwriters for use in I-D atmospheres and furnished by the company are to be used in the extraction area.
4. EXTENSION CORDS: Only I-D approved extension cords and lights are to be used in the extraction building. These may be used only when the plant is shut down and purged.
5. CLOTHING: Clothing made of synthetic material such as rayon, nylon, dacron, orlon, etc. may generate static electricity and should not be worn in the extraction area.
6. SHOES: All employees in the extraction building must provide themselves with safe shoes. Safety shoes are recommended. Steel nails in soles and heels are to be replaced with brass nails. No hob nails, buckle shoes or steel plates of any kind may be worn in the building.
7. REPAIRS TO LIVE CIRCUITS: Before any electrical fixtures or covers can be opened for repairs or adjustments the circuit controlling such fixtures must be "killed" and the control switched locked in the open position. This circuit must be kept open until the fixture is completely reassembled and explosion proof. This applies even to changing light bulbs and resetting switches.
8. COVERS ON ELECTRICAL FIXTURES: Maintenance men and other personnel must constantly check covers on electrical fittings. All ground wires must be kept intact. All plates and covers must be tight at all times. Electric conduit are not to be used for walking, climbing or tying onto.
   Class I-D fittings are designed to confine an explosion, and any opening whatsoever can permit an internal explosion to spread.
9. ELECTRIC POWER TOOLS: are not allowed in the building without the permission of the superintendent and then only when the plant is shut down and purged of solvent and vapors. Air driven tools may be used if the tool is properly grounded to prevent the buildup of static electricity. All air hoses must be of static-free type. Abrasive grinders and jack-

hammers are only to be used when the plant is purged and free of solvent vapors.

10. ELECTRICAL APPLIANCES: No standard electrical equipment, such as fans, blowers, radios, clocks or motors, may be taken into the extraction or preparation building. Water coolers, clocks, refrigerators, telephones, etc. must have the I-D label.
11. INTERNAL COMBUSTION ENGINES: driving autos, trucks, air compressors, welders, pumps, etc. are not to be allowed within the fenced area or within fifty feet of the extraction building.
12. NON-SPARKING TOOLS: Hand tools made of a non-sparking alloy only should be used in the extraction building. All tools used in the extraction building must be approved by the superintendent and stored on a non-sparking tool board. Steel tool boxes are not permitted. All approved tools will be marked green for easy identification.
13. NON-SPARKING EQUIPMENT: All shovels, wheelbarrows, drums or other equipment used in the extraction building should be aluminum or brass, or have all edges that might cause a spark covered with non-sparking material. If other metallic objects such as piping, grating sections, etc. are moved, extreme care must be used to avoid sparks.

    All metallic objects such as tanks of ammonia, nitrogen, freon, carbon dioxide or chlorine are to be protected with canvas bags or socks before they are taken into the extraction building.
14. FLAMMABLE LIQUIDS: in laboratories, such as hexane, are to be kept in "U. L. Approved" safety containers. No solvent is to be kept in open drums or buckets in the extractor building.
15. NO COMBUSTIBLES: No unnecessary combustible material may be brought into or left in the buildings.
16. OILY RAGS, WASTE AND ABSORBENTS: used to wipe up oil, solvent, paint, grease, or solvent soaked meal are to be put immediately after use into aluminum waste cans. These cans are to be emptied and their contents taken to a safe location at least once every day.
17. LEAKS: Any leaks of hexane or other liquids must be reported quickly to prevent vapor in the building. Miscella or half-miscella dripping on a pipe covering or other absorbent material can cause trouble. The hexane will evaporate, leaving oil which can ignite spontaneously.
18. BUILDING VENTILATION: The exhaust system of extraction building is designed to remove hexane vapors as they accumulate. Specified fans must be kept running at all times.
19. PHOTO EQUIPMENT: The use of any type of flash bulbs, strob light or flood lights for picture taking is prohibited unless the plant is shut down and purged.
20. MSA OR JOHNSON ALARMS: The Mine Safety Appliances, Johnson or portable explosimeters are available to detect the presence of flammable vapors. They should be maintained in proper working condition at all times. Each intake point of this system is to be tested at least weekly to be sure the system is working.

    In case the alarm trips, the intake point causing the trouble is to be checked at once. The exhaust fans should be checked to be sure they are working properly, then the cause of excess vapors is to be determined and steps taken to eliminate the cause.
21. BREATHING VAPORS: Hexane vapors in small quantities are not poisonous; but, if they replace enough oxygen in the air, they can cause suffocation. If the oxygen content goes below 16% (about 20% hexane vapors), it will not support life. Hexane vapors are heavier than air and settle in low places.

    Spent flake bins may contain dangerous concentrations of vapors. Any tank, or the extractor which has contained solvent or miscella, must be checked before a man enters them. (See special rules for entering vessels.)
22. SKIN IRRITATIONS: Continued exposure to hexane will dry natural oils from the skin and cause chapping.

    The use of hand creams or vaseline before exposure will help control chapping. If an employee expects to be unduly exposted to solvent, he should wear special gloves, aprons, etc.
23. LADDERS: All ladders must be equipped with ladder shoes. Care must be taken to see that ladders are safely placed while being used on the metal grating floors of the extraction building.
24. FIRE FIGHTING: A fire in the unit does not necessarily mean that it will blow-up the plant. Prompt action and intelligent handling is essential. The entire crew in the unit is a fire brigade and must be thoroughly familiar with the use and limitations of each type of fire fighting equipment. In the event of fire, they must:
    a. Turn in the fire alarm to the City Fire Department.
    b. Use available fire fighting equipment to extinguish the fire.
    c. If there is any question as to the fire department locating the problem area, a man should be sent to direct the fire department.
25. UNLOADING HEXANE: This is hazardous and procedural instructions must be followed carefully. Complete grounding of equipment, the use of only nonsparking tools and the posting of warning signs must be done before unloading hexane from either tank cars or tank wagons. At least one plant attendant must be on hand during this operation.
26. HOUSEKEEPING: The extraction building and the surrounding area are to have the best possible housekeeping.

    Each shift is responsible for the cleaning of certain areas designated by the superintendent.

    Spills or other abnormal conditions are to be cleaned up immediately by the crew then on duty.

    Grass or weeds cannot be allowed to grow anywhere around the area.
27. SAMPLE CONTAINERS: Sample containers and sampling devices shall be of nonsparking construction.
28. FIRE BLANKETS: are provided in the extraction building. These "fire-proof" blankets can be rolled around a person whose clothing is on fire. They are folded in their protective boxes so that a person whose clothes are on fire can wrap them around himself without help.
29. FENCE GATES: The gates in the fence enclosing the extraction building may not be locked at any time. They are to be kept closed with seals that can be broken easily.
30. SAFETY INSPECTIONS: During each shift the operator will check places where leaks of liquid may occur. The outside solvent trap is to be checked with the portable tester each shift and a record made of this reading on the log sheet. If there is any indication of solvent loss, the foreman should be notified.

    Other inspections will be made by authorized personnel.

SPECIAL SAFETY RULES:

1. REPAIR PROCEDURE: Repair work is done in the extraction building under one of three general types of conditions.
    a. Routine repairs while operating.
    b. Repairs necessary during emergency shutdown conditions.
    c. Complete shutdown—plant purged.

    a. Routine repairs while operating. This type of repair would include changing of light bulbs, repairs to condensate system, leak repairs, etc.

    If possible, or practical, equipment should be removed from the building for repairs, being sure no vapors remain inside before repairing.

    No soldering, welding or open flame devices will be permitted.

    All repairs above the ground floor will be made over a clean grommet-free tarpaulin to eliminate the possibility of sparks from dropped material. If sections of grating must be removed, the opening must be protected, and as soon as possible the sections replaced and the grounding clips reconnected.

b. Repairs necessary during emergency shutdown conditions. This type of repair is the most potentially hazardous. Plant operations are generally in an upset condition and the possibility of solvent vapors being present is greatly increased.

Problems in the extractor or solvent wet flake conveying equipment are particularly hazardous and this type equipment must not be opened without the express permission of the superintendent. He will direct the operating depending upon his analysis of the problem and its solution. No specific procedure can be issued covering all problems.

No one should enter an extractor or vessel in the extraction building without at least one other person in attendance outside the vessel. The person entering should be properly equipped with safety belt, rope, MSA gas mask and other related respiratory devices, such as a Scott Air-Pak.

In no case should repairs be attempted when the vapor concentration is in excess of 30% of the L. E. L. (lower explosive limit). Frequent monitoring of the area is required to be sure the concentration is not increasing. It may be necessary to blind off all liquid and vapor lines to the equipment under repair to prevent a buildup of solvent vapors.

c. Complete shutdown. At times, a complete shutdown for repairs or changes will be necessary. All liquids and flakes should be removed from the equipment and the building before starting repair work. All vessels should be completely purged, lines drained and appropriate blinds installed. Solvent supply pumps should be locked out to prevent accidental starting.

The superintendent will issue special instructions for this operation and will supervise the purging, testing and repair work. Normally, under such conditions, any type of work can be done.

2. ELECTRICAL: All repair work on motor-driven equipment must not be started until the unit being repaired is locked out at the motor control center. In addition to this, a "Men Working" tag should be hung on the starter. Only the man making the repairs is allowed to remove the tag and lock-out after repairs are completed. His name should appear on the tag. If several crafts are involved in the repair, each craft must provide their own lock and be responsible for removing it.

Only qualified personnel may make repairs to electrical equipment.

3. VISITORS: Visitors will be permitted to the extraction or preparation area only when approved by the manager or superintendent.

Visitors must apply at the office, and if approved, sign releases, leave lighters, matches, smokes, etc. in the office, have their shoes inspected, and have a general explanation of the safety rules.

If a visitor's shoes contain steel nails that could cause a spark, he can be supplied with a pair of shoe covers or have them taped.

Visitors will be escorted through the unit with a guide. Not more than ten visitors allowed in the plant at a time, and they must stay with their guide. No guide should have more than five visitors in a group. Visitors are not permitted to use the manlift, use the stairs.

Visitors must not be taken into the extraction building if dangerous concentrations of vapors are present. Such visits will have to be cancelled or postponed until the situation is corrected.

If trouble, such as fire or excessive solvent vapor conditions develop while visitors are in the building, the guide should be quietly notified, and the visitors immediately escorted from the building.

No employee is to admit friends, relatives or others to the enclosure without permission from the office. We must have an accurate record of who is in the building at all times.

4. WARNING SYSTEM: Whenever excessive solvent vapors are present due to spills, loss of a vent seal, etc., the flashing warning light and audible horn or siren should be activated. All construction work, welding, internal combustion engines, grinding, burning, etc. within 150 feet of the extraction building should be immediately stopped. Work may be resumed only after the flasher is turned off.

ABSTRACTS

R. A. REINERS, Editor. ABSTRACTORS: J. G. Endres, J. Iavicoli, K. Kitsuta, F. A. Kummerow, Gladys Macy, E. G. Perkins, T. H. Smouse, J. A. Thompson and R. W. Walker

• Fats and Oils

MARGARINE MANUFACTURE IN THE SOVIET UNION. B. Solomon (Doc. Ser. Inst. of Fats and Oils, Paris, Fr.). *Rev. Franc. Corps Gras* **15**, 93–100 (1968). A very comprehensive and complete review is given of the margarine industry in the Soviet Union. Trends in the utilization of raw materials, formulation, equipment, handling, storing, transport and analysis are given.

TECHNOLOGY OF EDIBLE FATS OBTAINED FROM RAPESEED OIL AND OTHER CRUCIFERAS OILS. B. F. Teasedale (Canada Packers, Toronto, Canada). *Rev. Franc. Corps Gras* **15**, 3–13 (1968). A review of the technology of processing rapeseed oil is presented. Emphasis is placed upon degumming, alkali and acid refining, hydrogenation, deodorization, formulation of margarines, shortenings and salad oils. The beneficial and detrimental effects of the minor components (phosphatides, chlorophyll, tocopherol, sulphur containing compounds) and of the fatty acid composition of the triglycerides on processing techniques and on the properties of the finished products is considered. Data concerning the laboratory and commercial processing of zero-erucic rapeseed oil (Canbra) are presented. Canbra was developed and is being grown commercially in Western Canada.

DESCRIPTION OF A SIMPLIFIED DIFFERENTIAL THERMAL ANALYZER SUITABLE FOR THE EXAMINATION OF SOLID FATS. R. Perron and A. Mathieu (Lab. of Lipochem. C.N.R.S., Thiais, Fr.). *Rev. Franc. Corps Gras* **15**, 23–26 (1968). A simple and reproducible differential thermal analyzer, with which a practically constant (2C per min.) temperature rise can be assured between 0C and 60C, is described. The device is particularly adapted to the examination of solid fats.

NATURE OF TRIENES FORMED DURING THE BLEACHING BY ACTIVATED EARTHS I. R. Guillaumin and J. F. Pertuisat (Inst. for Fats and Oils, Paris, Fr.). *Rev. Franc. Corps Gras* **15**, 27–33 (1968). It has been shown that the appearance of conjugated trienoic systems during bleaching is due to a chemisorption reaction. This reaction leads towards the formation of a major chemical species which does not display any conjugated ketone function, but belongs to the olefinic class, that is, 3 ethylene conjugated double bonds in a fatty acid molecule.

II. *Ibid.*, 85–91. Using successive preparative column chromatography with solvents having a successively increased polarity (hexane to chloroform), a group of components was isolated from the methyl esters of refined peanut oil which constitute the precursors of the triene formation during bleaching. When the isolates (mostly hydroacids and hydroperoxides) are treated with an activated montmorillonite, a fraction is obtained which represents in absorption the total conjugated triene system absorbing at 270 mm of the initial oil after bleaching. It has been further shown that the C18 acids with three conjugated *cis, trans, trans* and *trans, trans, trans* double bonds are essentially involved.

PRO AND ANTIOXIDANTS IN THE FIELD OF FATS. XX: LIPIDS OF YEAST CELL IN DIFFERENT STAGES OF GROWTH. H. P. Kaufmann, A. K. S. Alhad and S. S. Radwan (Inst. for Fat. Res., Munster (Westf.) Ger.). *Fette Seifen Anstrichmittel* **68**, 1010–1016 (1966). It has been shown that the amount of lipids in cultures of *Saccharomyces cerevisiae* and the composition of these lipids depends on the age and the growth of the yeast cells. Under anaerobic conditions, the lipids of different classes are diminished and converted to physiologically less active compounds, such as sterols from squalene. Oxygen is necessary for the biosynthesis of phospholipids and sterol esters.

STUDIES ON THE FORMATION OF HYDROCARBONS IN FATTY ACIDS AND FATTY ACID ESTERS IRRADIATED WITH UV RAYS. H. Luck, Q. N. Rahman and R. Kohn (Ger. Inst. for Nutritional Chem., Munchen, Ger.). *Fette Seifen Anstrichmittel* **68**, 1030–1037 (1966). It has been shown that the UV irradiation of saturated fatty acids and fatty acid esters in the presence of air and under vacuum produces unsaturated hydrocarbons. These hydrocarbons are probably 1,2-alkenes whose chains are shorter than the corresponding fatty acids by 2 carbon atoms. The volatile compounds in the unsaponifiable matter of UV-irradiated oleic acid comprise predominantly carbonyl compounds.

PHASE EQUILIBRIUM DIAGRAMS. AN APPROACH TO THE FORMULATION OF SOLUBILIZED AND EMULSIFIED SYSTEMS. J. Swarbrick (Sch. of Pharm., Univ. of Conn. Storrs, Conn.). *J. Soc. Cosmetic Chemists* **19**, 187–209 (1968). Phase equilibrium diagrams offer a convenient method for expressing the phase equilibria of ternary systems of the type common to solubilized and emulsified systems. The underlying principles of these diagrams are presented, together with a discussion of their application in the rational formulation of solubilized and emulsified products. Particular emphasis is placed on the relationship between distribution of the components of the system within and between the phases present and the physical stability, chemical stability and biological activity of the final product.

EFFECT OF IONIZING RADIATION ON FATS VIII. FORMATION OF WATER IN OILS AND FATS INDUCED BY IRRADIATION. R. Kohn (Ger. Res. Inst. for Nutritional Chem., Munchen, Ger.). *Fette Seifen Anstrichmittel* **69**, 323–325 (1967). Irradiation of peanut oil and lard with gamma rays from a cobalt-60 source led, depending upon the dose (10^4 to 10^8 rad), to the formation of free water. Water was measured by the Karl Fischer method. The formation of water can be explained on the basis of currently accepted conceptions of radiolytic decomposition of esters, fatty acids, hydroperoxides and alcohols.

ENZYMATIC DETERMINATION OF TRIGLYCERIDE CONTENT OF PHOSPHATIDE PREPARATIONS. J. Holzl (Inst. for Pharm., Munchen, Ger.). *Fette Seifen Anstrichmittel* **69**, 328–330 (1967). A method for the determination of the triglyceride content of phosphatide preparations, which eliminates the separation of lipids is described. The fatty acid esters are saponified, and the glycerine in the water soluble part of the hydrolyzed product is determined enzymatically with the help of glycerokinase, lactic dehydrogenase and pyruvic-kinase. The method is specific and suitable for serial analysis.

PHYSICAL PROPERTIES OF TRIGLYCERIDES. II: DISPERSIONS. T. H. Gouw and J. C. Vlugter (Dept. of Chem. Eng., Technol. Univ., Delft, The Netherlands). *Fette Seifen Anstrichmittel* **68**, 999–1001 (1966). The liquid state dispersions of a number of triglycerides at 20C and 40C are presented. From these data the Lorentz-Lorenz and the Gladstone-Dale molar dispersion were calculated. A previously derived general equation is used to compute a quantitative relation between the dispersion of a mixture of triglycerides and its refractive index, density and iodine value.

GAS CHROMATOGRAPHY OF SOLVENTS. J. Benes. *Chem. Prumysl* **17/42**, No. 5, 261–6 (1967). Gas chromatographic separations of unknown solvent mixtures are made on two types of stationary phase: (1) tricresyl phosphate (polar); (2) squalane (non-polar). The logarithms of the retention volumes on two stationary phases are plotted for a number of hydrocarbons, alcohols, ethers, esters, *etc.* The slopes of the straight lines are different for different types of compounds. When the type of compounds present in the solvent mixture is known it is possible to find the best stationary phase for separation of homologues. Polypropylene glycol (15%) at 125C gives good separation of aliphatic hydrocarbons. Aromatic hydrocarbons are separated on Reoplex 400 (15%) at 141C. Separation of *m*-xylene and *p*-xylene can only be achieved on 1-naphthylamine, phenylenediamine and benzyldiphenyl stationary phases. Amines are separated in Apiezon L: KOH (1:1) (15%) stationary phase at 125C. C_6–C_{10} alcohols are best separated on Reoplex 400 (15%) at 160C, lower alcohols on paraffin oil at 100C. Dinonyl phthalate and tricresyl phosphate are good stationary phases for the separation of ethers, ketones and esters. Details of particular separations are given. (Rev. Current Lit. Paint Allied Ind. No. 309.)

SOME OILSEEDS FROM TROPICAL HERBACEOUS CROPS. J. A. Cornelius and W. D. Raymond. *Tropical Sci.* **9**, No. 2, 75–89 (1967). The origin, composition, processing and utilisation of the products of groundnuts, sesame, castor, cottonseed and soyabeans are outlined and features peculiar to each oilseed species are dealt with. (Rev. Current Lit. Paint Allied Ind. No. 309.)

5-α-ANDROST-16-ENE-3-ONE: COMPOUND RESPONSIBLE FOR TAINT IN BOAR FAT. R. L. S. Patterson (Meat Res. Inst., Cambridge, England). *J. Sci. Food Agr.* **19**, 31–7 (1968). The compound 5-α-androst-16-ene-3-one, which has been isolated from boar

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Meetings

AOCS National Meetings

1968—New York, Statler Hilton Hotel, Oct. 20–23.
1969—San Francisco, San Francisco Hilton, April 20–24.
Minneapolis, Leamington Hotel, Oct. 5–8.
* April 26–30, 1970—New Orleans, Jung Hotel.
* Sept. 27–Oct. 1, 1970—Chicago, Conrad Hilton Hotel.

Other Organizations

Aug. 12–16, 1968—Fluorescence and Phosphorescence Spectrometry, Saul Gordon Associates, Lake Hopatcong, N.J.
Aug. 11–16, 1968—Heat Transfer Conference and Exhibit, Bellevue-Stratford Hotel, Philadelphia, Pa.
Aug. 19–21, 1968—The 48th Annual Convention of the American Soybean Convention, Roosevelt Hotel, New Orleans.
Aug. 19–20, 1968—ASTM Committee E-1 on Methods of Testing, Sub. on Thermo-Analytical Methods, Holy Cross College, Wooster, Mass.
Aug. 26–30, 1968—Bio-Physical Techniques Workshop, Saul Gordon Associates, Lake Hopatcong, N.J.
Sept. 1–5, 1969—Second Meeting of the International Society for Neurochemistry (ISN), Milan, Italy.
Sept. 9–11, 1968—Third International Symposium on Drugs Affecting Lipid Metabolism, Milan, Italy.
Sept. 9–12, 1968—12th International Conference on the Biochemistry of Lipids, University of Loughborough, England.
Sept. 12, 1968—Symposium on the Synthesis and Uses of Labelled Lipids and Sterols, Milan, Italy.
Sept. 8–12, 1968—The 12th International Conference on the Biochemistry of Lipids, University of Loughborough, England.
Sept. 12–13—Society of Cosmetic Chemists, Seminar, Sheraton Hotel, Boston, Mass.
Sept. 16–21, 1968—IXth Congress of International Society for Fat Research (ISF), Rotterdam, Netherlands.
Sept. 18–20, 1968—ASTM Committee C-3 on Chemical-Resistant Nonmetallic Materials, Sheraton Boston, Boston, Mass.
Sept. 24–27, 1968—ASTM Committee E-19 on Gas Chromatography, Netherland Hilton, Cincinnati, Ohio.
Sept. 20–Oct. 4, 1968—ASTM Fall Meeting & Materials Testing Exhibit, Marriott Motor Hotel, Atlanta, Ga.
* Oct. 8–10, 1968—ASLE/ASME Lubrication Conference, Chalfonte-Hadden Hall, Atlantic City, N.J.
Oct. 14–17, 1968—82nd Annual Meeting of the Association of Analytical Chemists, Marriott Motor Hotel, Twin Bridges, Washington, D. C.
Oct. 15–16, 1968—83rd Annual Meeting of Industrial Hygiene Foundation, Chatham Center, Pittsburgh, Pa.
Oct. 23–25, 1968—46th Annual Meeting and 33rd Paint Industries' Show of the Federation of Societies for Paint Technology, New York Coliseum, New York City.
Dec. 3, 1968—Award Meeting and Medal Award Dinner Dance, Americana Hotel, New York, N.Y.

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* Additions to previous calendar

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fat but which has not been detected in either hog or gilt fat, is responsible for the odor, generally considered to be offensive, of heated shoulder, back and rump fat of mature boars. However, it is recognized that their are other odors associated with a mature boar and that these may also influence the general odor quality of heated boar flesh. The molecular structure of the identified compound points unequivocally to the male sex hormones as the precursors for its formation although the exact metabolic pathway is not yet clear.

PREPARATION OF FATTY ACID METHYL ESTERS BY THE PHOTOCHEMICAL REACTION BETWEEN DIAZOMETHANE AND LIPIDS. W. O. Ord and P. C. Bamford (Unilever Res. Lab., Welwyn, England). *Chem. Ind. (London)* **1967**, 2115–6. Fatty acid methyl esters can be prepared quantitatively by photochemical-diazomethane treatment of egg yolk lecithin, soybean cephalin and other phosphatides. The reaction is carried out during 15 min. under a U.V. lamp in alkaline medium. The method is able to convert mono-, di- and triglycerides into methyl esters, but not sphingomyelins, cerebrosides or cholesteryl oleate. No *cis-trans* isomerization was observed during the irradiation experiments.

PROPORTION OF GS_3 IN SOME C_{16}–C_{18} ACID VEGETABLE SEED FATS AND THEIR RELATION TO THE SATURATED ACIDS COMBINED AT C(1), C(2) AND C(3) POSITIONS. A. R. S. Kartha (Indian Agr. Res. Inst., New Delhi, India). *Chem. Ind. (London)* **1967**, 1959–60. The proportions of GS_3 analyzed in a number of vegetable seed fats containing C_{16}–C_{18} fatty acids are extremely low and do not agree with the concept of random distribution of fatty acids between the C(1), C(2) and C(3) positions if the C(2) saturated acid values obtained by pancreatic lipase hydrolysis are assumed to be reasonably correct. The fats covered by this study were: cocoa butter, kokum butter, phulwara butter, *Vateria indica* seed fat, mowrah fat and neem oil.

METHOD FOR MAKING FLUID OLEAGINEOUS SUSPENSIONS. W. S. Schroeder and J. R. Wynne (National Dairy Products Corp.). *U.S. 3,369,909.* A method for the manufacture of a stable, two-phase, fluid oleagineous suspension comprises heating a mixture of an edible oil and 8–13% by wt. of a triglyceride hard fat having an I.V. of less than 8 and at least 85% C_{18} and longer fatty acid radicals. The mixture is heated to a temperature sufficiently high to melt the hard fat and destroy its crystal nuclei and then cooled to a temperature within the beta crystalline range and maintained at that level until substantially all of the hard fat has crystallized in the beta phase.

DETERIORATION OF FRYING OIL IN AUTOMATIC TEST FRYER. II. METHOD OF HEATING. Etsuji Yuki (Food Ind. Expl. Sta, Hiroshima Pref.). *Yukagaku* **17**, 295–9 (1968). Deterioration of frying oil during deep fat frying was examined by use of a direct heating, indirect heating and heating tube method. Good frying was not obtained by improper method of heating which resulted in thermal decomposition of frying oil.

EFFECT OF METALS ON THE AUTOXIDATION OF METHYL OLEATE. Tomishi Yamada and Yoshiyuki Mochida (Kanagawa Univ., Yokohama). *Yukagaku* **17**, 309–12 (1968). Effect of metals on the autoxidation of methyl oleate was investigated by observing the changes in peroxide value, iodine value, acid value and refractive index during autoxidation of the oleate in the presence of 0.1% benzoyl peroxide and metal stearate (0.05% as metal) at 50 and 80C. Such metals as Co(II), Cr(III), Mn(II), Fe(III), Pb(II) and Cu(II) remarkably accelerated the peroxide formation and decomposition, while Ag, Zn, Mg, Ca, Sr, Ba, Hg and Cd showed little effect. Ni showed little effect at 50C but accelerated the peroxide formation at 80C.

GAS-LIQUID CHROMATOGRAPHY OF THERMAL POLYMERIZATION PRODUCTS OF METHYL LINOLEATE. Tetsutaro Hashimoto, Osamu Suzuki and Keizo Tanabe (Gov. Chem. Ind. Res. Inst., Tokyo). *Yukagaku* **17**, 299–305 (1968). Temperature-programmed gas-liquid chromatography is found to be useful for the determination of monomer and dimer contents. The monomer and dimer fractions can be quantitatively separated on column of 1.5% silicon rubber-coated Chromosorb W, with the column temperature being programmed from 200 to 310C at a rate of 7.5C per min. The monomer and dimer contents can readily be determined from the peak

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• *Names in the News*

Verna Eadie has become Vice President of Atlanta-based American Lecithin Company. Associated with American Lecithin for more than 20 years in all phases of the business, Mrs. Eadie manages the New York operating headquarters.

Stanley G. Sourelis (1952), a registered professional chemical engineer, has been appointed President of OSHTA Inc., Engineers to the Vegetable Oil Industry, as of May 15, 1968.

During the past 20 years, Mr. Sourelis has been responsible for over 90 successful custom engineered installations throughout the world, incorporating designs and inventions of his own making.

F. C. DiLuzio, Assistant Secretary of the Interior for Water Pollution Control, has resigned to become president of Reynolds Electrical & Engineering Co., and a vice president of Edgerton, Germeshausen and Grier, major contractors for the Atomic Energy Commission. His successor is M. N. Edwards, Assistant to the Secretary of the Interior and Legislative Counsel.

J. M. Quigley, Federal Water Pollution Control Administration Commissioner, has also submitted his resignation and will become vice president for United States Plywood Champion Paper Corporation. His expected successor is J. G. Moore, Jr., executive director of the Texas Water Development Board.

D. B. Batchelor has been named Director of Purchasing for Mallinckrodt Chemical Works. The announcement was made by W. F. Michener, Vice President and General Manager of the Industrial Chemicals Division. Mr. Batchelor will be responsible for the purchase of chemical raw materials and containers for the Company's more than 1500 products, printed materials, mechanical equipment and office supplies.

J. M. Harris has been named marketing sales manager for coatings materials for the paper industry according to R. D. Visger, manager of Coatings and Monomers Sales for The Dow Chemical Company. Harris previously had similar responsibilities for Dow coatings materials for the Packaging industry.

C. C. Armstrong has been given additional duties as head of the Madison Division of the Dow Chemical Company and will now be General Manager of the Madison Division and Corporate Engineering and Construction Services. In announcing Armstrong's appointment, E. B. Barnes, director of manufacturing, said that Gerhard Ansel, division manager at Madison since 1962, will transfer to a new assignment which will be announced later.

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• *New Literature*

Chas. Pfizer & Co., Inc., has become the first U.S. producer of pharmaceuticals and chemicals to transmit data to and from its European facilities at speeds up to 1200 words a minute. The "Datal" (data-telephone) system, recently installed by ITT World Communications, Inc., is expected to streamline Pfizer's overseas communnications, transmitting groups of messages that were formerly sent individually at a rate of 66 words a minute.

Specifications and chemical composition of 26 long and short chain Neo-Fat fatty acids are tabulated in a two-color, four-page booklet prepared by Armour Industrial Chemical Company. Product specifications include titer, iodine value, acid value, color, moisture, heat stability, saponification value and unsaponifiable content. Chemical compositions are determined by gas chromatography. (Bulletin 68-8, Armour Industrial Chemical Company, Box 1805, Chicago, Ill. 60690.)

Sigma Instruments, Inc., announces a new catalog bulletin describing the Sigma OEM Indicating Controller 9222. Designed specifically for use as a component in machinery, furnaces, ovens, or other equipment requiring indication or control of a process variable, the 9222 combines the advantages of exceptional performance, a large, easily read meter scale, custom calibration, compact size—less than 3 × 6-inch panel space—and low price. Options, specifications and ordering information are included. Bulletin No. 1172 Sigma Instruments, Inc., Braintree, Mass. 02185.)

William J. Hacker & Co., Inc., has available a four-page brochure describing the new Reichert Microprojector "Visopan," which combines a microscope, projection screen and light source into a single compact unit eliminating space and alignment problems. The light source consists of a 100-watt halogen (iodine quartz) lamp. Magnifications range from 50 × to 800 ×. (P.O. Box 646, West Caldwell, N.J. 07007.)

Rex Chainbelt, Inc., has published bulletin 315-71, on its skimming equipment. Used widely today in industrial and municipal water and waste treatment applications, Rex Skimmers perform the vital function of removing floating oil, scum and sludge from waste water. (Sales Promotion Department, Rex Chainbelt Inc., P.O. Box 2022, Milwaukee, Wis., 53201.)

The LacConCo Corporation has introduced the Micro Kjeldahl Digestor, with a 1-in. thick Marinite 23 heat board to insulate wiring and rheostats from heat, ceramic heater tops to handle 30 ml or 100 ml flasks. Both the glass manifold for water ejection, or rack for use in a fume hood models are available in 115 volt or 230 volt AC. (8811 Prospect, Kansas City, Mo. 64132.)

Gow-Mac Instrument Company has released a new Flow Minder, Model 30–100. This instrument eliminates the time-consuming practice whereby laboratories are forced to individually set all gas flow test and measurement equipment to night time standby conditions and reverse the procedure for normal day operation. The Flow Minder, by the flip of a switch, automatically reduces pressure to the correct level for stand-by and reverses the procedure for operational periods. (Bulletin SB FM, 100 Kings Road, Madison, N. J. 07940.)

Gamma-globulin can be efficiently isolated from serum or plasma without denaturation by use of electrodecantation principle. E-C Apparatus Corporation's Electroconvection Cell and procedure are described in a new brochure from the company. The one-step operation accepts up to 250 ml of sample and isolates the globulin on the basis of its isoelectric point. Purity may be increased by reprocessing the gamma-rich fraction. Adjustment of pH allows sequential isolation of other components. (755 Marks St., Philadelphia, Pa. 19104.)

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area. If desired, the trimer content can be estimated from the residue on the column under the assumption that the amount of tetramer and higher polymers in the polymerization products is small. Results of analysis of monomeric isomers by isothermal gas-liquid chromatography suggest that an octadecamonoenoate is formed during the thermal polymerization of methyl linoleate.

STUDIES ON THE OIL ADDITIVES. II. PREPARATION OF ZINC DIALKYL DITHIOPHOSPHATES AND THEIR ANTIOXIDATION EFFECTS. Kenji Negoro and Sumio Akamatsu. *Yukagaku* **17**, 312–15 (1968). Reaction conditions for preparation of dialkyldithiophosphates from 4 moles of alcohol and 1 mole P_2S_5 have been investigated. When the alcohol having an alkyl chain of less than 4 carbon atoms is used as starting material, the optimum reaction temperature and time are 5–7 hrs. at 50–60C. When the alcohol has 5–8 carbon atoms in alkyl chain, 3 hrs. at 100C is best. Reaction above the recommended temperature ranges decreases the yield. The autoxidative potency of the Zn salt of these products was tested by measurement of induction period for uptake of oxygen in liquid paraffin. The decrease of this induction period was in the order of 4-methyl-2-pentyl, cyclohexyl, sec-butyl, 2-ethylhexyl, iso-amyl, n-hexyl and 2-octyl in alkyl radical of dialkyldithiophosphate. The first 3 Zn salts are excellent antioxidants.

ANALYSIS OF CYCLOPROPENOID ACIDS BY GAS-LIQUID CHROMATOGRAPHY. J. H. Recourt, G. Jurriens and Mrs. A. Schmitz (Unilever Res. Lab., Vlaardingen (The Netherlands)). *J. Chromatog.* **30**, 35–42 (1967). The possibility of analyzing cyclopropenoid acids by means of gas-liquid chromatography (GLC) was investigated using three different gas chromatographic apparatus, equipped with on-column injection, a silver injection system and stainless steel injection system, respectively. Four different supports were compared as well as two different silicone immobile phases and two polyester immobile phases. Reliable results could be obtained with on-column injection using silicone immobile phases and Diatoport S or Gaschrom Q as support. In the methyl esters of *Pachira aquatica*, a new cyclopropenoid acid was found. By means of mass spectrometry, infrared and nuclear magnetic reasonance analysis, the structure could be identified as that of 2-hydroxysterculic acid. The same acid could be detected in *Pachira insignis* and *Bombacopsis glabra* based on retention time (GLC) and R_F value (TLC).

THE RECOVERY OF TRACE ELEMENTS AFTER THE OXIDATION OF ORGANIC MATERIAL WITH 50 PERCENT HYDROGEN PEROXIDE. J. L. Down and T. T. Gorsuch (Barking Regional College of Technol., Longbridge Rd., Dagenham, Essex). *The Analyst* **92**, 398–402 (1967). The recovery of several elements, at the p.p.m. level, from various organic materials after oxidation with sulphuric acid and 50% hydrogen peroxide has been studied. Most of the elements investigated could be recovered quantitatively, but germanium, arsenic, selenium and ruthenium suffered losses under some or all of the conditions examined. The causes of these losses are discussed.

THE EXAMINATION OF TOCOPHEROLS BY TWO-DIMENSIONAL THIN-LAYER CHROMATOGRAPHY AND SUBSEQUENT COLORIMETRIC DETERMINATION. K. J. Whittle and J. F. Pennock (Dept. of Biochem., Univ. of Liverpool, Liverpool 3, Eng.). *The Analyst* **92**, 423–30 (1967). A two-dimensional thin-layer chromatographic system has been used to separate tocopherols and tocotrienols before determining them by the Emmerie-Engel reaction. Reproducible recoveries of about 92% were obtained with authentic tocopherols and the method was used to determine tocopherols and tocotrienols in several vegetable oils. A compound, apparently plastochromanol, has been identified in some oils.

HIGH OLEIC ACID SAFFLOWER OIL. R. H. Purdy and B. J. Campbell (Pacific Veg. Oil Corp., 1145 South 10th Street, Richmond, Calif.). *Food Technol.* **21**, 349–50 (1967). Recent varietal studies of the iodine value of safflower seed (*Carthamus tinctorius L.*) revealed introductions in which the proportions of oleic and linoleic acids are reversed. Breeding

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W. C. Ault Named for 1967-68 Northeast Section Achievement Award

Dr. W. C. Ault (1941) has been named to receive the Achievement Award of the Northeast Section, American Oil Chemists' Society, to be presented at the September 17 Meeting in New York City. The award, established in 1966, recognizes outstanding contributions to the field of fats and oils through research or industrial development.

W. C. Ault

From 1942 until his retirement in 1967, Dr. Ault was Chief of the Animal Fat Products Laboratory of the Department of Agriculture, Eastern Utilization Research and Development Division, Wyndmoor, Pa. The research Dr. Ault headed at the Laboratory is responsible for many significant and large-scale uses for animal fats, especially the inedible grades which lost their primary market when soap was largely displaced by detergents made from coconut oil and petroleum. Studies initiated by Dr. Ault and carried out under his direction are responsible for developing plasticizers from fats, including the widely used epoxides and also vinyl-stearate effective in copolymers; for opening up a multimillion-pound-per-year market for animal fats in poultry and other livestock feeds; for basic research that has created new markets for fats in lubricants and in other fields; and for developing detergents from animal fats that are inherently more biodegradable than petroleum-based detergents.

Among Dr. Ault's early contributions to research on fats and oils are the development for a method for treating low grades of animal tallows and greases so that they can be used effectively in making synthetic rubber; devising a simple and practical method of purifying commercial oleic acid (red oil) to make it suitable for many chemical uses; improving the quality of lard oil by an inexpensive solvent process; and establishing the stabilizing value of small quantities of vegetable shortening added to lard during rendering.

For these and many other accomplishments, Dr. Ault received a succession of awards during his years as a USDA scientist. In 1956 the Department presented him with a Superior Service Award for his personal achievements. On four previous occasions he had received the same award as the head of effective research teams. Dr. Ault received a special award of recognition from the National Renderers Association in 1964.

Before coming to the Eastern Utilization Research Laboratory in 1942, Dr. Ault worked for a year at USDA's Northern Laboratory in Peoria, Illinois. Before this, he spent 4 years with the Monsanto Chemical Company, and 3 years with the United Gas Improvement Company.

Born on a farm near Van Wert, Ohio, Dr. Ault was educated at Ohio State University where he was a Phi Beta Kappa graduate in 1930 and received his Ph.D. degree in 1934. He is the author of about 70 publications and 20 patents covering various phases of fat chemistry.

For a number of years he was Adjunct Professor of Chemistry at Drexel Institute of Technology. Since his retirement he has served as consultant to Applied Science Laboratories, Inc., State College, Pennsylvania.

An active member of the American Oil Chemists' Society and Associate Editor of its Journal, Dr. Ault was chairman of the Society's program committee in 1957. He was also program chairman of the society's national meetings in 1955, 1960, and 1966. He has served on the AOCS education committee, and has been active in its Short Course program, for which he was program chairman in 1962.

Dr. Ault has also been active in the American Chemical Society, and in 1957 he served as Chairman of its Philadelphia Section. He is a member of the American Association for the Advancement of Science and the Philadelphia Organic Chemists' Club.

Executive Board Appointed for International Food Science and Technology Meeting

Planning for the Third International Congress on Food Science and Technology, which will convene for the first time in the United States in 1970, will be handled by an Executive Board of distinguished scientists and executives.

The Congress will be held in Washington, under the sponsorship of the Institute of Food Technologists (IFT), a professional society headquartered here.

R. L. Hall, director of research and development, McCormick & Co., Baltimore, Md., is chairman of the Executive Board which is planning and organizing the Congress. Dr. Hall announced the following names of Executive Board members:

S. A. Goldblith, professor of food science and deputy department head, Massachusetts Institute of Technology, Cambridge, Mass.; W. A. Gortner, Human Nutrition Research Division, Agricultural Research Service, U.S. Department of Agriculture, Beltsville, Md.; and I. J. Hutchings, general manager, research and development, H. J. Heinz Co., Pittsburgh, Pa.

Also, A. N. McFarlane, chairman and chief executive officer, Corn Products Company, New York, N.Y.; Dr. J. H. Nair, consultant, Raleigh, N. C., and IFT immediate past president; H. S. Olcott (1957), professor of marine food science, University of California, Berkeley, and B. L. Oser, president, Food and Drug Research Laboratories, Maspeth, N.Y., and IFT president-elect.

Also, A. N. Prater, consultant, Encino, Calif., and IFT treasurer; P. E. Ramstad, vice president research, American Maize-Products Co., Roby, Ind.; G. F. Stewart, director, Food Protection and Toxicology Center, University of California, Davis, and IFT president, and C. L. Willey, executive director, Institute of Food Technologists, Chicago, Ill.

Members of the Executive Board accepting chairmanships of key committees include Mr. McFarlane, Fund Raising; Dr. Gortner, Secretariat; Dr. Prater, Budget and Control; Dr. Olcott, Program; Dr. Ramstad, General Arrangements, and Mr. Willey, Operations.

The Congress, which is held every four years, is for discussion and exchange of ideas in the areas of preservation, processing and development of appealing and nutritious foods. The two previous Congresses were in London in 1962 and Warsaw in 1966.

The Congress will comprise plenary sessions featuring lectures by well-known speakers on topics of worldwide importance, and technical symposia on specialized topics.

More than 3,000 scientists, technologists, engineers, nutritionists, educators, government officials and business executives from some 50 nations are expected to attend the sessions, which will be Aug. 9–14, 1970, in Washington, D. C.

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research has resulted in commercially feasible varieties with fatty acid compositions approximating 80% oleic, 15% linoleic and 5% saturated fatty acids. The oil obtained from the new varieties by laboratory extraction and refining is further characterized by low pour point, bland flavor and light color. Accelerated test methods suggest that oxidative stability is comparable to commercially available partially hydrogenated shortenings.

A LIMITED SURVEY OF FATS AND OILS COMMERCIALLY USED FOR DEEP FAT FRYING. J. A. Thompson, M. M. Paulose, B. R. Reddy, R. G. Krishnamurthy and S S. Chang (Dept. of Food Sci., Rutgers, The State Univ., New Brunswick, N. J.). *Food Technol.* 21, 405–7 (1967). A survey, by physical and chemical analyses, of fats and oils commercially used for deep fat frying indicated that their degree of deterioration is independent of their degree of unsaturation, but rather depends on how they are used. The degree of increase in viscosity, color, free fatty acid, peroxide value and non-urea-adduct-forming esters and the decrease in iodine value and content of unsaturated fatty acids demonstrated that some food processors maintain their frying oils in good quality while others abuse and damage theirs. The fatty acid composition of the used fat and oil samples, as analyzed by gas chromatographic method, do not add up to 100%. In a severely damaged frying oil, they accounted for only 84%. This may be due to the presence of polar and polymeric fatty acids which cannot be eluted under the normal conditions for analysis of fatty acid composition by gas chromatography.

EFFECT OF DIETARY FAT AND PROTEIN ON LIPID COMPOSITION AND OXIDATION IN CHICKEN MUSCLE. J. E. Marion, T. S. Boggess Jr. and J. G. Woodroof (Food Sci. Dept., Univ. of Georgia, Georgia Station, Experiment, Georgia). *J. Food* Sci. 32(4), 426–29 (1967). Samples of white muscle (*pectoralis major*) were taken from 100 male, broiler-type chickens which had been reared to 58 days of age on rations differing in protein level and in type of supplemental fat. Lipids were extracted from each sample and fractionated into (1) neutral lipids, (2) cephalin and (3) lecithin. Correlation coefficients between TBA values and level of each lipid component were obtained after treatment effect was statistically removed. The 22 carbon fatty acids with four or five double bonds in cephalin and lecithin, and linoleic acid in neutral lipids and lecithin were positively correlated with TBA values.

FAT QUALITY AND STABILITY IN DEHYDRATED PROTEINACEOUS FOOD MIXES. S. J. Bishov, Y. Masuoka and A. S. Henick (U. S. Army Natick Lab., Natick, Mass.). *Food Technol.* 21, 466–68 (1967). The effect of initial quality as determined by peroxide value of rendered chicken fat on the stability of chicken-flavored soup and gravy mix subjected to accelerated storage was determined by oxidation rate studies and by a trained acceptance panel. Both commercially-obtained and laboratory-rendered chicken fats, adjusted to a range of peroxide values from 2 to 10, with and without added antioxidant, were blended with the other components of a standard soup and gravy mix. Oxidation rates of the chicken fats alone were compared with those of the same fats in the soup mix. Rates of chicken fat were affected by added antioxidant, while those in the soup mixes were not.

PEA LIPOXIDASE, DISTRIBUTION OF ENZYME AND SUBSTRATE IN GREEN PEAS. C. E. Eriksson (Swedish Inst. for Food Pres. Res. (SIK), Goteborg 16, Sweden). *J. Food Sci.* 32(4), 438–41 (1967). The extractable enzyme was found mainly in the cotyledon, where its concentration was highest. The concentration of the enzyme was somewhat higher in the inner than in the outer part of the cotyledon. Both free and bound fatty acids were found in all parts of the pea. The oxidation rate of linoleic acid, catalyzed by lipoxidase, was found independent of oxygen partial pressures above about 20 mm Hg. The respiratory rates of intact and damaged green peas were determined.

LIPIDS IN WHEAT KERNELS OF VARYING SIZE. C-M. Chiu and Y. Pomeranz (Dept. of Grain Sci. and Ind., Kansas State Univ., Agr. Res. Ser., Manhattan, Kansas 66502). *J. Food Sci.* 32(4), 422–25 (1967). The hard red spring kernels had, generally, more free lipids than hard red winter kernels; differences in bound lipids were small. Total lipid content

(Continued on page 466A)

Graduate Support for Solid Wastes Management Specialty for an M. S. Degree at the University of Illinois

This new program is an interdepartmental effort among Civil Engineering (Sanitary Engineering Division), Food Science, and Agricultural Engineering. The program will provide students the opportunity to specialize in solid wastes management while gaining a broad education and earning a graduate degree within any one of the participating Departments. Graduates from this program will be qualified for employment with industries, public health agencies and consulting firms.

The University of Illinois has received a grant from the National Center for Urban and Industrial Health, USPHS, to support the program. Full time graduate student traineeships are available in the amount of $3,000 per year plus tuition and fees. For more information contact: Professor R. T. Milner, Head, Department of Food Science, University of Illinois, Urbana, Illinois 61801.

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• *Obituaries*

DR. RALPH W. BOOKER (1961), founder of R. W. Booker & Associates, Inc., Consulting Engineers, St. Louis, Mo., died on May 13, 1968 at the University of Washington Hospital in Seattle.

DR. L. W. KINSELL, head of the Institute for Metabolic Research at Alameda, California, and his wife died on July 9, 1968.

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• *Edible Rendering . . .*

(Continued from page 430A)

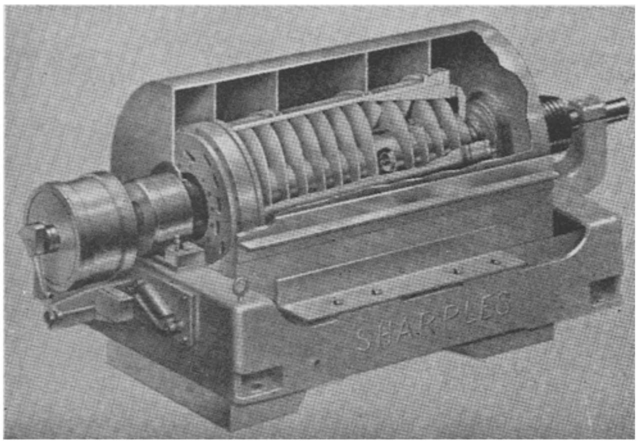

FIG. 7. Cut-away view of a Sharples P-3000 Super Decanter.

quired to vary the plant capacity. The system is easily cleaned by flushing with hot water or cleaning solution and can be switched over to any desired type of raw material with minimum loss in production time. The centrifugals used in the De Laval process have all liquid contact parts for fat and protein of all 316 SS. They can be cleaned in place, under normal conditions, without being taken apart.

The De Laval Animal Fat Separator can be kept in full operation even when the fat supply is stopped and is, accordingly, very flexible for extreme plant conditions. Utility requirements are extremely low: maximum .2 lbs of steam per lbs of fat produced; maximum .01 kwh per lbs of fat produced. It is ideal where space is limited; the average systems of 10,000 lbs/hr of raw fat trimmings can be installed in 250 sq ft of floor area with an average 14-ft headroom.

Table IV shows some typical results on this process, as given by the manufacturer. Table V shows the analysis of fats so produced. The lard results are based on pork trimmings from killing floor and/or cutting floor. The edible tallow results shown are based on beef trimmings such as caul, ruffle, and kidney. Brisket trimmings have a higher protein content, and yield figures are slightly lower. The free fatty acid content and peroxide value of the purified tallow and lard are dependent upon the quality of the whole feed to the system. There is no increase of the free fatty acid or peroxide value during processing. Edible de-fatted pork tissue can also be produced by this process. To obtain approval from the U.S.D.A. for their use however, the trimmings must be free from skin, bones, and hair.

Table VI shows a comparison of this system with the conventional methods on beef and a comparison of recovery based on 1,000 lbs of raw fat, consisting of 800 lbs lard/tallow, 160 lbs water, and 40 lbs insoluble solids, protein, etc. Table VII shows a comparison of the utility requirements.

The Sharples system, although basically the same as the De Laval, merits some discussion. Figure 6 shows a schematic diagram, Figure 7 a cut-away view of a Sharples P-3000 Super Decanter. This horizontal centrifuge separates meat fibers and protein tissue from fats from a

TABLE VI

Comparison of Recovery Based on 1,000 Lbs of Raw Fat (Consisting of 800 Lbs Lard/Tallow, 160 Lbs Water, 40 Lbs Insoluble Solids, Protein, Etc.)

Products Recovered	De Laval Centriflow Straight Rendering		Tank Rendering	
			Edible	Inedible[b]
Yield in Fat in %	Beef 99%	Pork 97%	Beef or Pork 96%[a]	Beef or Pork 99.5%
Edible fat	792#	776#	768#	
@ $0.10/lbs				
Value in $	$79.20	$77.60	$76.80	
Cracklings wet	120#	[c]	None	None
@ $0.05/lbs				
Value in $	$ 6.00			
Cracklings dry		44#	44#	44#
(10% fat)				
@ $0.03/lbs				
Value in $		$ 1.32	$ 1.32	$ 1.32
Inedible fat		12#	28#	796#
@ $0.05/lbs				
Value in $		$ 0.60	$ 1.40	$39.80
Total recovery in $	$85.20	$79.52	$79.52	$41.12

[a] Based on average wet-rendered lard yield. Dry-rendered lard/tallow has higher yield but relatively poorer quality.

[b] Inedible fat is almost always dry-rendered.

[c] Wet cracklings from pork fat in Centriflow Process cannot be sold as dog food; they are too sticky because of glue. They have to be sent to inedible department for recovery of dry cracklings (10% fat) and inedible fat.

(Average annual operation, 2,500 hours. Table VII shows a comparison of the utility requirements.)

Type SAMN Separator Bowl

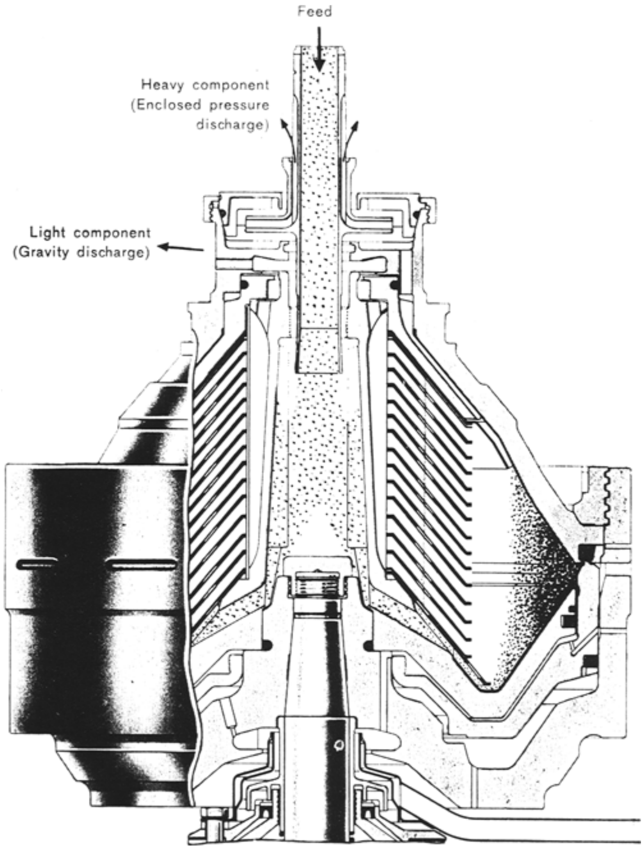

FIG. 8. Diagram of a Type SAMN separator bowl.

TABLE VII

(Based on 1,000 lbs of Raw Fat)

	De Laval		Tank rendering	
Electricity				
Per 1,000 lbs of raw fat	**10 KWH**		**Nil**	
Price per KWH	**$0.01**			
Price per 1,000 lbs	**$0.10**			
Steam				
Per 1,000 lbs of raw fat	**150 lb**		**1,500 lb**	
Price per 1,000 lbs steam	**$1.00**			
Price per 1,000 lbs fat	**$0.15**		**$1.50**	
Total utility cost	**$0.25**		**$1.50**	
Applied to plant size	**Per Hour**	**Annual[a]**	**Per Hour**	**Annual[a]**
2,000 PPH	**$ .50**	**$1,250**	**$ 3.00**	**$ 7,500**
5,000 PPH	**1.25**	**3,125**	**7.50**	**18,750**
10,000 PPH	**2.50**	**6,250**	**15.00**	**37,500**
De Laval savings annual as compared with plant size				
2,000 PPH				**$ 5,250**
5,000 PPH				**15,625**
10,000 PPH				**31,250**

[a] Average annual operation, 2,500 hours operation.

(Continued on page 464A)

• AOCS Commentary

(Continued from page 426A)

becomes more and more difficult to operate under a situation where the President of the Society is in office but a single year and in many cases has only one year as a Vice-President to become knowledgeable about the affairs of the Society and the people with whom he must work. The 1968 changes in the By-Laws of the Society provided for the addition of several committees and for one new Director. The committees that were established were an Executive Committee which was designed entirely to assist the President in reaching decisions where it was nearly impossible to get a decision of the entire Governing Board in time to make a reasonable decision. It was not the intent that the Executive Committee would replace the Board of Directors, it was simply intended that the Executive Committee be available to take action when the President deemed it unnecessary to present matters to the entire Board and providing the members of the Excutive Committee were in agreement that the entire Board need not be canvassed. Experience has indicated that the formation of an Executive Committee was not only timely, but exceedingly useful. It has relieved the Board of much detail, has assisted the President greatly, and has brought more information and thought into every decision it has been necessary to make.

The By-Laws changes of 1968 also provided for the establishment of a Director of Publications. Previous to 1967 the Society had but one publication—*JAOCS*. With the introduction of *Lipids* the need for dual publication committees, one for *JAOCS* and one for *Lipids,* became evident. As a result the Director of Publications, who was Chairman of the Publications Committee, was established and provision made for editors for any journal which the Society might publish at any time. These changes were part of the 1968 By-Laws revisions.

With the introduction of the Award for Lipid Chemistry and a continuation of the Bond Award program, the need for a committee to handle the total award program of the Society became evident. Accordingly, the By-Laws established an Awards Committee and defined its objectives.

For a number of years the question has been raised as to whether or not the Society should have specialty sections as well as geographical sections. Although the Governing Board had discussed in certain instances the desirability of such a change, no real decisions had been reached. In the new By-Laws provisions have been made for the introduction of either geographical or specialty sections, and the conditions under which they will be admitted to the Society and the conditions under which they may operate as AOCS sections. Such a change is a step forward and fulfills a need for future growth of the Society.

In the above paragraphs the changes in the 1968 Articles of Incorporation and the By-Laws of the Society and the needs which lead these changes have been discussed. We have not discussed herein those changes which were needed simply to revise wording, to clarify intent and to simplify the sections. We have not pointed out that all sections of both the Articles of Incorporation and the By-Laws have been given specific headings. This has not been done because it makes good sense to also accomplish these small things when attention is given to the major changes needed. It is hoped that this discussion will clarify the reasons for the 1968 changes, and will make us all more aware of the need to renew the Articles of Incorporation and our By-Laws at regular intervals. Above all else, we hope that each and every member of the Society is aware of his responsibilities with regard to the rules under which we operate and even more aware of the fact that under the original Constitution and By-Laws and under the revised Articles of Incorporation and By-Laws the decision to change remains in the hands of the majority of the voting membership.

R. C. Stillman, Chairman
Constitutional Study Committee

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• New Products

An automatically controlled microfurnace, providing new convenience and precision for thermal microscopy, has been introduced by the Mettler Instrument Corporation of Princeton, New Jersey. Designated the Mettler FP-2, this instrument relieves the researcher of all operations which used to distract him during microthermal investigations: temperature regulation, temperature readout, and the repeated recording of the result. By greatly increasing precision, convenience, and temperature control, the FP-2 makes thermal microscopy a highly reproducible research and analytical method.

E. H. Sargent & Co. announces a new series of recorders for the laboratory, the SRG series. This line of laboratory recorders features three different models: The model SRG, versatile and flexible, a laboratory instrument incorporating the means not only for tracing a record on chart paper, but also for amplification, filtering, rejection, suppression, discrimination, and time relation; the model SRG-GC, ideal recorder for use with all types of gas chromatographs, it provides the analyst with a chart positioned for ready observation and convenient annotation while the chromatogram is being recorded; and the model SRLG, which includes all the features of the model SRG and also provides a choice of direct or logarithmic response for continuous, precise recording of an electrical variable or its logarithm with respect to time, or with respect to any other variable which may be synchronized in time; the SRLG may be used with spectrophotometers, photometers, densitometers, and similar instruments to record either transmittance or absorbance.

For complete information on this new series of Sargent recorders, write for bulletin to E. H. Sargent & Co., 4647 West Foster Avenue, Chicago, Illinois 60630.

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• *Edible Rendering . . .*

(Continued from page 462A)

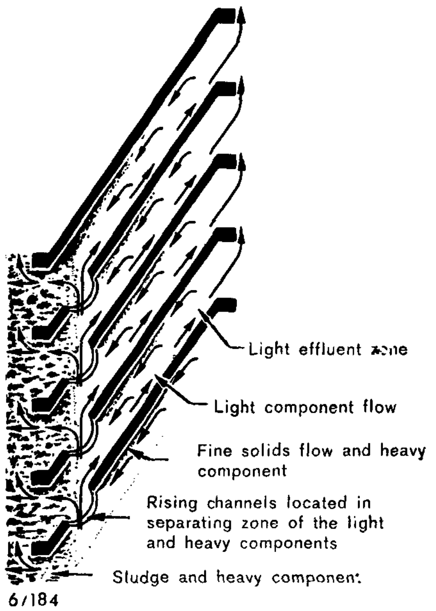

FIG. 9. Operating principles of the discs for separation (Sharples).

mixture which enters just to the right of mid-point. The helical screw inside the bowl rotates in the same direction as the bowl but at a slightly slower speed. Meat and protein solids deposited against the bowl wall are conveyed by the screw to end at right and discharged; the separated fat liquid is discharged from the end at left.

Figure 8 shows a cross-section of a bowl from one of the Westfalia Automatic Desludger centrifuges. Figure 9 shows the operating principles of the discs for separation.

Good-quality lard and tallow may be produced by either rendering system. The hazard to quality resulting with the production of sour lard may result from souring of the hashed fat in the feed tank, caused by an interrupted operation, or from excessive protein and water in the finished lard, causing it to sour in transit. The establishment of a small simple laboratory to analyze the fat for moisture and free fatty acid and the solid residues for fat is beneficial.

TABLE VIII
Average Fat Trimmings per Animal

1. Pork Fat Trimmings—average per animal			
Killing Floor Fats			
Leaf fats	8 lbs		
Ruffle fats	3 lbs		
Others	1 lbs		
		Subtotal	12 lbs
Cutting Floor Fats			
Back fats	8.5 lbs		
Plate fats	6 lbs		
Ham fats	1.5 lbs		
Loin trimmings	5 lbs		
Shoulder fat	4 lbs		
Belly strips	3 lbs		
		Subtotal	28 lbs
		Total Fat Trimmings	40 lbs
2. Beef Fat Trimmings—average per animal, killing floor or internal fats			
Ruffle fat	7.5 lbs		
Paunch	6 lbs		
Casing	5 lbs		
Caul	5 lbs		
Others	1.5 lbs		
		Subtotal	25 lbs[a]
Cutting floor			
Suet (kidney fat)	9 lbs		
Cod fat	6 lbs		
Brisket fat	6 lbs		
Shop fats	14 lbs		
		Subtotal	35 lbs
		Total Fat Trimmings	60 lbs

[a] In some areas killing-floor fats per beef are considerably higher than average.

Table VIII from the De Laval Company shows the Average Fat Trim.

Complete automation of compact, continuous rendering systems that may be cleaned in place with sensing devices for oil clarity and quality is the current trend. They also tend to increase profits and minimize waste treatment.

ACKNOWLEDGMENT

The author is indebted to The National Provisioner, June 10, 1950; JAOCS, *26*, 575; Food Technology, XIII, No. 2, 132–135; Food Processing, February 1963; The De Laval Separator Company; and The Sharples Division of The Penn Salt Company.

• *New Books . . .*

(Continued from page 428A)

the many areas of this active field, particulary materials of a more fluid nature. The articles are well written; all are prefaced with an outline, a valuable aid when specific information is desired. The chapters are well illustrated with figures and tables which should be helpful. All of the chapters are documented extensively with references and crossreferences. The chapter on Rheology of Liquid Crystals is very timely in that work in this area has escalated. The section on rheological terminology should be valuable since it is desirable to have definite meanings to terms which the authors have made an excellent attempt to establish.

The book would serve well as a text on rheology and is highly recommended for scientists working in the field where up-to-date knowledge of the science of flow of materials is of importance. It would be a worthwhile addition to the library of research organizations.

The book is printed on a good quality paper and is bound in hardback. It has a subject index, 211 bibliographic references, a number of excellent figures and tables, and is well edited. The dictionary included in this volume will be available as a separate booklet.

DONALD MITCHAM
Research Physicist
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FLUORESCENCE: cTHEORY, INSTRUMENTATION AND PRACTICE. Edited by George G. Guilbault (Marcel Dekker, Inc., p. xxviii + 697, 1967 $15.25).

The symposium held April, 1967 by the Analytical Division of the American Chemical Society included fourteen speakers who expanded their talks to be presented in the book. Despite its multi-authored origin the index, table of contents and author index are wholly adequate.

The book is divided into three major areas as the title suggests. The three theoretical chapters are advanced; one would not recommend these chapters to a reader with little knowledge of fluorescence. However, if one first read about fluorescence in a general book such as Uderfriend's *Fluorescence Assay in Biology and Medicine* (Academic Press, 1962), he would have the background to appreciate theoretical chapters in this book. Most of the remaining chapters are very readable, even for a novice. In addition to learning about fluorescence, the reader can learn much about related areas of chemistry. Biochemical examples are often used and some subjects such as protein structure, enzyme kinetics, active transport and photosynthesis are discussed in depth. Metal chelation, kinetic methods of analysis and atomic flame spectrometry are among the other subjects which are discussed.

Many examples of polarization of fluorescence are given with various chapters. This important technique is often misunderstood or ignored. The examples of polarization presented should help overcome this barrier.

The book offers the beginner an opportunity to learn about the wide application of fluorescence, while the experienced user of fluorescence has the opportunity to read current reviews about the application of this sensitive technique. It is a book at which most researchers should at least glance, if not read with care.

Henry Weiner
Department of Biochemistry
Purdue University
Lafayette, Indiana 47907

Chemistry: A Conceptual Approach, by Charles E. Mortimer (Reinhold Publishing Corporation, New York, 1967, 692, pp., $8.95).

A mark of an excellent teacher is the simplicity and clarity with which he presents and explains concepts. If the comment applies appropriately to this book, the author is a student's favorite. The chapters on thermodynamics and kinetics, subjects which are often difficult for students, are sound mathematically yet do not require mathematical thinking for understanding. What the author says in equations he also says clearly in words.

Other chapters which are particularly well-handled include chemical bonding, acids and bases, ionic equilibria and nuclear chemistry.

The chapter on acids and bases describes in a most lucid way the evolution of views from the Arrhenius concept through the Bronsted-Lowry and Lewis concepts.

The remaining chapters include conventional treatment of atomic structure, chemical bonding, chemical equations and quantitative relationships, gases, liquids, and solids, solutions, electrochemistry, oxygen and hydrogen, metals and non-metals.

The chapter on organic chemistry, in this reviewer's opinion, is too brief and the subject of biochemistry is omitted. Students who have the opportunity to include only one year of chemistry in their curriculum are thus short-changed on these important subjects.

The book not only provides the student with an excellent presentation of chemistry in textbook form, it also includes provocative questions at the end of each of the 18 chapters. Its usefulness should not be confined to programs of college students; it should also be a very useful reference book for many chemists who completed their formal training at various stages of chemical thinking and now wish to bridge the gap with modern chemical concepts.

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Professor of Biochemistry
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• *Industry Items*

Two massive cryogenic heat exchangers, believed to be the largest pieces of chemical process equipment ever shipped abroad in assembled form, have just been shipped by Air Products and Chemicals, Inc. to Libya, where they are destined for the liquefaction of natural gas as a means of transportation of gas to other countries. Air Products not only engineered and built the units but also designed the gas liquefaction process.

The Glidden-Durkee Division of SCM Corporation will build a completely new and modern $10 million edible-oil refinery near Joliet, Ill., for the production of its Durkee Famous Foods line, W. G. Phillips, Glidden-Durkee president, has announced.

The refinery will refine and process crude edible oil to a finished state for sale through food processors, restaurants, and institutional users. Oil processed at the new facility will include soya, cotton, peanut, corn, coconut, palm kernel oils, and others.

The Biological Science Laboratories of Foster D. Snell, Inc., have moved into new and enlarged quarters at 800 Dowd Ave., Elizabeth, N.J.

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• *AOCS Past Presidents Series*

J. C. KONEN, 1958


J. C. Konen

James C. Konen was the 49th president of the Society.

Jim was born in North Dakota in 1909. He attended North Dakota State College where he obtained his B.S. Degree in 1933 and M.S. in 1935. He was awarded a Doctor of Science Degree from that institution in 1959. He also attended the Harvard Advanced Management School where he graduated in 1955.

His first job was with the Firestone Co. in 1934 in a sales area. He started with Archer - Daniels - Midland in 1935 and remained there until 1967. From 1943-52 he was Director of Industrial Research. He became an Assistant Vice President in 1953 and was Vice President in Charge of Research, Developmeent, Engineering and Quality Control from 1955–63. In 1963 he was placed in charge of Overseas Operations of the Chemical Group. He is now with the Ashland Chemical Co., who purchased the Chemical Activities of A.D.M.

His AOCS Committee activities include Membership, 1945–46; 1951–, F.A.C., 1946–; Smalley 1947–50; Seed and Meal Analysis, 1949–; San Francisco Convention Program, 1950; Governing Board, 1951–1953; Chairman, Minneapolis Convention, 1954; Education, 1959–60.

Jim, like Norris Embree who followed him, was active in the plans for the Golden Anniversary. This feature along with increasing the dues and modifying the advertising setup constituted the out-of-the-ordinary activities according to Jim.

Jim and Mrs. Konen now reside in Columbus, Ohio. They have a son, John, and a daughter, Elizabeth Anne.

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1968 CIBS Award Presented

William J. Armswood, Jr., President of the Cosmetic Industry Buyers' and Suppliers' Association, presented the 1968 CIBS Award at a luncheon for the Joint Conference on Cosmetic Sciences, Washington Hilton Hotel, Washington, D.C., last April.

The award is presented to the author or authors of the most meritorious paper, as judged by the Editorial Board of The Proceedings of the Scientific Section of The Toilet Goods Association, delivered at the TGA Scientific Section meetings during the preceding year.

Recipients of the 1968 CIBS Award are D. E. McOsker, and D. P. Hannon, of The Procter & Gamble Company for their paper on "Ultrastructural Studies of Dandruff—Involved Scalp Tissue." The paper was given at the May, 1967 Scientific Section meeting and appears in Scientific Section Proceedings No. 47.

Dr. McOsker was graduated from Oklahoma State University in 1952 with a B. S. in Chemistry. He earned his M.S. in Biochemistry also from Oklahoma State and in 1956 he received his Ph.D. from Cornell University, Ithaca, New York. Dr. McOsker is currently Manager of Special Skin Research, Bar Soap and Household Cleaning Products Division, The Procter & Gamble Company, Miami Valley Laboratories.

Mr. Hannon attended the University of Cincinnati Evening College while working as control laboratory supervisor for Toms River Chemical Corporation. For the past seven years, Mr. Hannon has been a member of The Procter & Gamble Company's Microscopy Group.

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(Continued from page 461A)

per kernel depended primarily on kernel size, and was affected little by wheat class or variety. Thin-layer chromatography showed triglycerides as the major nonpolar component, and digalactosyl glyceride and phosphatidyl choline as the major polar components. Concentrations of individual nonpolar or polar components were not affected significantly by kernel size.

Determining volatile acids in coffee beverages by NMR and gas chromatography. J. T. Kung, R. P. McNaught and J. A. Yeransian (Tech. Center, Gen. Food Corp., White Plains, N. Y. 10602). *J. Food Sci.* 32(4), 455–58 (1967). Formic acid was determined by NMR, the remainder by gas chromatograph. The difference in acid concentration between medium- and dark-roasted coffees was also examined. Acetic acid and formic acid are the major volatile acid components; C_3 to C_{10} acids are present only in relatively small amounts in the three varieties investigated. Robusta coffee was found to be significantly higher in formic acid and slightly lower in acetic acid than Colombian and Santos.

Identification of 2-pentyl furan in fats and oils and its relationship to the reversion flavor of soybean oil. R. G. Krishnamurthy, T. H. Smouse, B. D. Mookherjee, B. R. Reddy and S. S. Chang (Dept. of Food Sci., Rutgers, The State Univ., New Brunswick, N. J.). *J. Food Sci.* 32(4), 372–74 (1967). 2-Pentyl furan is identified as a component of the volatile decomposition products of slightly autoxidized soybean and cottonseed oils and those of thermal oxidation of corn oil and hydrogenated cottonseed oil. The flavor threshold of this compound in oil at room temperature is 1 ppm. At concentrations of 1–10 ppm, it imparts to the oil a characteristic beany odor and flavor reminiscent of a reverted soybean oil. Expert organoleptic panels consistently identified a deodorized cottonseed oil containing 5 ppm of 2-pentyl furan as a reverted soybean oil.

Nature of the residual lipids in fish protein concentrate (FPC). B. F. Medwadowski, J. Van Der Veen and H. S. Olcott (Inst. of Marine Res., Dept. of Nutr. Sci., Univ. of Calif., Berkeley, Calif. 94720). *J. Food Sci.* 32(4), 361–65 (1967). Isopropanol-extracted samples had 0.1–0.2% residual lipid and an ethylene dichloride-extracted sample had approximately 0.5% residual lipid. The lipids contained 50–60% neutral lipid, 20–25% phospholipids, 5–10% acidic lipids and the remainder uncharacterized. Fatty acid analysis of the total lipids showed that the saturated fatty acids were mainly palmitic and stearic and the unsaturated fatty acids were mainly oleic and palmitoleic.

Programmed temperature gas chromatographic technique for detecting trace amounts of fatty acids. J. L. Iverson (Div. of Food Stand. and Add., Washington, D. C. 20204). *J. Assoc. Off. Anal. Chem.* 50, 1118–23 (1967). The value of varying the rate of temperature increase during temperature programmed gas chromatography is illustrated by its application to fractions of cocoa butter oil, palm kernel oil, butter oil and cod liver oil. Column overloading and changing programming rates during an analysis have been found necessary to detect fatty acids present in parts per million. Since specific methods cannot be detailed for the analysis of complex fractions, guidelines are presented which are useful in obtaining optimum results.

Lipids produced by Epicoccum nigrum in submerged culture. F. H. Foppen and O. Gribanovski-Sassu (Istituto Superiore di Sanita, Rome, Italy). *Biochem. J.* 106, 97–100 (1968). The lipids of the red mycelium of the fungus *Epicoccum nigrum* Link were investigated. Four carotenoid pigments were isolated and identified as β-carotene, α-carotene, rhodoxanthin and torularhodin, rhodoxanthin being isolated for the first time as a fungal metabolite. Linoleic acid was the major fatty acid in the total lipids. Ergosterol was present in the lipids in the non-esterified form.

Observations on the lipid metabolism of germinating seeds of Cucurbita maxima, III. L. G. Federico, T. Benelli, A. Farini and A. Daghetta (Univ. of Milan, Milan, Italy). *Riv. Ital. Sostanze Grasse* 45, 143–50 (1968). The consumption of lipids occurring during germination and initial development of *Cucurbita maxima* is not accompanied by significant changes in triglyceride distribution. A preferential attack by the lipase of *Cucurbita maxima* on triglycerides containing linoleic acid in the 2-position has been observed.

Peroxide determination by Stamm's method. M. Solina (Olive Oil Inst., Pescara, Italy). *Riv. Ital. Sostanze Grasse* 45, 140–2 (1968). A colorimetric method, based on Stamm's reaction, has been applied to the determination of the peroxide index of Italian olive oils. The method gives results in good agreement with the iodometrically determined peroxide index.

Determination of the color characteristics of a group of Italian olive oils by the trichromatic method. M. Luise (Univ. of Pescara, Pescara, Italy). *Riv. Ital. Sostanze Grasse* 45, 70–82 (1968). The results, in trichromatic coordinates, of color measurements carried out on 462 Italian olive oil samples are reported. The frequency distributions have been plotted for dominant wavelength, hue saturation and brilliancy.

Oil color determination by a rational method. C. Carola, G. Jacini, W. Ciusa and G. Bigoni (Fats and Oils Exper. Stat., Milan, Italy). *Riv. Ital. Sostanze Grasse* 45, 83–98 (1968). The basic concepts of the CIE method of color determination are reviewed, and a simplified method, based on readings taken at five wavelengths, is proposed for use in determining the color of fatty oils. Comparative results by the standard CIE method and the simplified method confirm that the latter appears to be valid for all oils, including refined oils. According to this proposal, the color of an oil would be expressed by means of three figures: dominant wavelength, saturation and transmission.

• Fatty Acid Derivatives

Obtaining the pure methyl ester of linolenic acid. A. D. Popoy and Y. Yanishlieva. *Comptes Rendue de l'ABS.* 19, No. 7, 615–8 (1966) (in German). Methyl linolenate of $>$99% purity was separated from the methyl esters of linseed oil by urea adduct and mercuric acetate adduct formation. The composition of the fractions obtained was checked by gas chromatography. (Rev. Current Lit. Paint Allied Ind. No. 310.)

Electrochemical alcoholysis of glycerides. M. M. Falkovich and K. M. Goldberg. *Lakokras. Mat.* 1967, No. 4, 6–9. Two improved electrolytic cells for the alcoholysis of triglycerides of fatty acids with monohydric alcohols have been developed and are illustrated schematically. The electrodes giving the best performance were those of metals which could act as alcoholysis catalysts. The use of the proposed cells made the alcoholysis more rapid, reduced the process temperature and improved product quality. (Rev. Current Lit. Paint Allied Ind. No. 310.)

The preparation of 1-aminoethyl-2-alkyl-2-imidazolines with long alkyl groups. O. Dobozy (Organ. Chem. Res. Inst., Budapest, Hungary). *Tenside* 5, 145–8 (1968). It is shown by I.R. spectra that the cyclic imidazoline derivative is formed by a condensation reaction between diethylene triamine and sperm oil fatty acid. The reaction does not, however, proceed quantitatively since, depending on the reaction conditions, more or less linear by-products are also formed, mainly acid amides.

Process for preparing modified alkyd resins having increased resilience and resistance to cracking. D. A. Bennett (International Synthetic Rubber Co.). *U.S. 3,375,214.* A process for preparing a modified alkyd resin having increased resilience and resistance to cracking, comprises (1) reacting a solvent material such as glyceride oil, unsaturated fatty acids and mixtures of unsaturated oils with at least one saturated fatty acid, with a rubbery polymer of a conjugated diene having a molecular weight of 5,000 to 200,000 and being soluble in the fatty solvent material, by heating a solution of the two materials to produce a reaction product having a viscosity not greater than about 100,000 poises at 25C, and (2) reacting the product of the above reaction with a polyhydroxy compound and a material selected from the group consisting of organic dibasic acids and organic dibasic anhydrides.

• Biochemistry and Nutrition

PHYSIOLOGICAL EFFECTS ON DOGS OF A VERY UNSATURATED OIL DETERIORATED BY HEATING. M. T. Lanteaume, P. Ramel, P. Acker, A. M. LeClerc and C. Wirth (Cent. Lab of Nutr.). *Rev. Franc. Corps Gras* 15, 71–79 (1968). Dogs were fed from weaning with a fat deficient but otherwise balanced dry food. This food was supplemented with up to 15% of either fresh or treated oil. Grapeseed oil which is rich in linoleic was heated for 48 to 96 hours at 200C in the presence of air. The heated grapeseed oil was fed for 6 months. The general state of the animals suffered no deterioration and their growth was not affected. Periodic biochemical examination showed no trouble with metabolism. There was an increase in the plasma clotting ability of the dog fed the heated fat. No organic lesions were detected.

FATTY ACID SYNTHESIS IN INTESTINAL MUCOSA OF GUINEA PIG. M. J. Tame and R. Dils (Univ. of Birmingham, England). *Biochem. J.* 105, 709–16 (1967). The presence of acetate-CoA ligase, acetyl-CoA-carbon dioxide ligase and fatty acid synthetase in particle-free fractions of guinea-pig intestinal mucosa was demonstrated. The incorporation of acetate and citrate into fatty acid was measured and gas-liquid radiochromatography was used to investigate the pattern of fatty acids synthesized. The rate-limiting step in fatty acid synthesis was shown to be acetyl-CoA-carbon dioxide ligase.

CITRATE AND THE CONVERSION OF CARBOHYDRATE INTO FAT. M. Fang and J. M. Lowenstein (Brandeis Univ., Waltham, Mass.). *Biochem. J.* 105, 803–11 (1967). The rate of fatty acid synthesis by particle-free extracts prepared from rat liver is increased greatly if the enzyme system is first activated with citrate, the extent of the activation being dependent on citrate concentration and on time of activation in an interdependent manner. Citrate activation is also strongly dependent on temperature. Magnesium ions can replace citrate in the activation but not in the complete reaction system; the activating effect of both citrate and Mg ions is prevented by ATP. Inhibition of fatty acid synthesis by palmitoyl-CoA can be prevented by palmitoyl-DL-carnitine or by increasing the concentration of protein.

THE STRUCTURE AND POSSIBLE FUNCTION OF THE GLYCOLIPID FROM STAPHYLOCOCCUS LACTIS I3. D. E. Brundish, N. Shaw and J. Baddiley (Univ. of Newcastle Upon Tyne, England). *Biochem. J.* 105, 885–9 (1967). The total lipid was extracted from *Staphylococcus lactis* I3 with chloroform-methanol mixtures and the glycolipid component was isolated by chromatography on silicic acid. Saponification yielded a non-crystalline glycoside for which the structure O-β-D-glucopyranosyl-(1→6)-O-β-D-glucopyranosyl-(1→1)-D-glycerol has been established by chemical degradations and by comparison with synthetic material. The role of the glycosyl diglycerides in bacterial membranes is discussed.

DIETARY AND OTHER FACTORS WHICH AFFECT SERUM LIPIDS. R. E. Hodges (Univ. of Iowa, Iowa City). *J. Am. Dietetic Assoc.* 52, 198–201 (1968). Recent journal publications are surveyed.

DIET AND CORONARY EVENTS. O. Turpeinen (College of Veterin. Medicine, Helsinki, Finland). *J. Am. Dietetic Assoc.* 52, 209–13 (1968). Studies designed to show the effect of a change of diet on the incidence of coronary events are reviewed briefly. The great majority of these studies have led to remarkably concordant results, indicating that the adherence to a serum cholesterol-lowering diet is followed by a decreased incidence of new coronary events.

THE ACTION OF DIGITONIN ON RAT LIVER MITOCHONDRIA. H. A. I. Newman, S. E. Gordesky, C. Hoppel and C. Cooper (Case Western Reserve Univ., Cleveland, Ohio). *Biochem. J.* 107, 381–5 (1968). The amount and types of phospholipid and the fatty acid composition of the various phospholipids were examined in intact rat liver mitochondria, in mitochondria devoid of their outer membrane (preparation A) and in small pieces derived from the disruption of the inner-membrane complexes (preparation B). The latter two preparations were obtained by digitonin treatment and carry out oxidative phosphorylation. The ratio μg. atoms of phospholipid P/mg. of protein was 0.163 for intact mitochondria, decreased to 0.118 in preparation A and increased markedly to 0.292 in preparation B. Examination of the various types of phospholipid present showed that the molar proportions cardiolipin:phosphatidylcholine:phosphatidylethanolamine were approx. 1:6:6 for intact mitochondria and 1:3:3 for preparations A and B. There was a correlation between the recovery of cardiolipin and adenosine triphosphatase activity in the conversion of intact mitochondria into preparations A and B. The fatty acid contents of the various types of phospholipid purified by TLC were identical in all three preparations. These results show a considerably higher content of arachidonic acid and lower content of oleic acid for phosphatidylcholine, phosphatidylethanolamine and phosphatidylinositol than have previously been reported for mitochondrial phospholipids.

THE INHIBITORY EFFECTS IN VITRO OF PHENOTHIAZINES AND OTHER DRUGS ON LIPID-PEROXIDATION SYSTEMS IN RAT LIVER MICROSOMES, AND THEIR RELATIONSHIP TO THE LIVER NECROSIS PRODUCED BY CARBON TETRACHLORIDE. T. F. Slater (Univ. College Hospital Med. School, London, England). *Biochem. J.* 106, 155–60 (1968). The effect of several phenothiazine derivatives on lipid peroxidation systems in rat liver microsomes were studied and the results are considered in relation to the hepatotoxic action of carbon tetrachloride. The lipid-peroxidation system coupled to NADPH$_2$ oxidation and stimulated by an ADP-Fe^{2+} mixture is strongly inhibited *in vitro* by promethazine and, less effectively, by chlorpromazine and Stelazine. Promethazine also produces an inhibition of the NADPH$_2$-ADP-Fe^{2+} system in liver microsomes after administration *in vivo*. It is concluded that the inhibition involves interaction of the drug (or a metabolite of it) with the microsomal electron-transport chain. Several other compounds known to protect the rat against liver necrosis after CCl$_4$ administration were tested for inhibitory action on the NADPH$_2$-ADP-Fe^{2+} system. No clear correlation was observed between effectiveness *in vivo* as a protective agent and inhibitory effects *in vitro*. Promethazine was found to inhibit the stimulation of lipid peroxidation produced in rat liver microsomes by low concentrations of CCl$_4$. This effect occurs at a concentration similar to that observed *in vivo* after administration of a normal clinical dose.

STUDIES ON LIPOGENESIS IN VIVO. G. R. Jansen, M. E. Zanetti and C. F. Hutchison (Merck Inst. for Therapeutic Res., Rahway, N.J.). *Biochem. J.* 106, 345–53 (1968). Lipogenesis was studied in mice re-fed for up to 21 days after starvation. At appropriate times glucose-U-^{14}C was given by stomach tube and incorporation of ^{14}C into various lipid fractions was measured. In mice starved for 48 hr. and then re-fed for 4 days with a diet containing 1% corn oil, incorporation of ^{14}C into liver fatty acids and cholesterol was respectively 3-fold and 8-fold higher than in controls fed *ad libitum*. The percentages by wt. of fatty acids and cholesterol in the liver also increased and reached peaks at 7 days. Radioactivity and weights of the fractions returned to control values after 10–14 days' re-feeding. These changes could be diminished by re-feeding the mice with a diet containing 20% corn oil. Incorporation of ^{14}C into extrahepatic fatty acids was not high during re-feeding with a diet containing either 1% or 20% corn oil. However, incorporation of ^{14}C into the fatty acids of the epididymal fat pads was increased in mice re-fed with either diet, as compared with non-starved controls. Lipogenesis was also studied in mice alternately fed and starved. The elevation in liver lipogenesis during re-feeding was greatest on a diet containing 1% corn oil, whereas in extra hepatic tissues, the increase in lipogenesis was greater when the mice were re-fed or were allowed limited access to a diet containing 20% corn oil. These results suggest that the causes of the increased rate on incorporation of ^{14}C from glucose-U-^{14}C into fatty acids during re-feeding may be different in liver from that in extrahepatic tissues.

THE EFFECTIVENESS OF A LIPID PEROXIDE IN OXIDIZING PROTEIN AND NON-PROTEIN THIOLS. C. Little and P. J. O'Brien (Univ. of Birmingham, England). *Biochem. J.* 106, 419-23 (1968). Thiol oxidation by a lipid peroxide or hydrogen peroxide was as efficient in denatured non-haem proteins as in small thiols. Both peroxides were relatively ineffective in oxidizing haemoprotein thiols, especially at low pH. Increased amounts of haematin greatly decreased the efficiency of GSH oxidation by peroxides, especially at low pH. Other than the haematin ring, the thiol group was found to be probably the group in proteins most sensitive to modification by peroxides. At low concentrations, the fatty acid moiety of a lipid peroxide appeared to impede thiol oxidation in proteins, probably by hydrophobic bonding to the protein, rather than to stimulate thiol oxidation by denaturing the protein and thereby increasing the exposure and reactivity of the thiol group. The relative rates of thiol oxidation by peroxides in the different thiols were: haemoprotein thiols > small thiols > other protein thiols. In all cases, thiol oxidation was much more rapid by the lipid peroxide than by hydrogen peroxide.

THE INHIBITORY EFFECT OF REDUCED GLUTATHIONE ON THE LIPID PEROXIDATION OF THE MICROSOMAL FRACTION AND MITOCHONDRIA. B. O. Christophersen (Univ. of Oslo, Oslo, Norway). *Biochem. J.* 106, 515–22 (1968). GSH efficiently inhibited the ascorbate-stimulated lipid peroxidation of the unsaturated fatty acids in the fresh microsomal fraction and mitochondria of rat liver, whereas the peroxidation in heat-denatured particles was little inhibited. Cysteamine and diethyldithiocarbamate inhibited the peroxidation in both fresh and boiled particles. Thioglycollate and 2-mercaptoethanol had no inhibiting effect. Cysteine and homocysteine both stimulated the lipid peroxidation even in the absence of ascorbate. Added GSH disappeared at nearly the same rate in the presence of fresh and of boiled particles to which ascorbate had been added, although considerably more malonaldehyde was formed in the boiled particles. In the absence of ascorbate little GSH disappeared. It is suggested that the protective effect of GSH against lipid peroxidation depends on the preservation of heat-labile structures in the microsomal fraction and mitochondria.

THE BIOLOGICAL CONVERSION OF 7-DEHYDROCHOLESTEROL INTO CHOLESTEROL AND COMMENTS ON THE REDUCTION OF DOUBLE BONDS. D. C. Wilton, K. A. Munday, S. J. M. Skinner and M. Akhtar (Univ. of Southampton, England). *Biochem. J.* 106, 803–10 (1968). It is shown that the 7-dehydrocholesterol reductase-catalyzed conversion of 7-dehydrocholesterol into cholesterol (II), with a 105000 g microsomal pellet of rat liver in the presence of 4-$^{3}H_2$ NADPH results in the transfer of radioactivity to the 7-β-position of cholesterol. When the conversion is carried out in the presence of tritiated water, the label is introduced exclusively at the 8-β-position. However, when the conversion of 7-dehydrocholesterol into cholesterol is performed with a 500 g supernatant of rat liver homogenate the radioactivity is incorporated at both the 7-β- and the 8-β-position. Evidence is provided for the presence of an enzyme system in the 500 g supernatant that catalyzes an equilibration of hydrogen atoms between those at the 4-position of NADPH and those of water. The work with stereospecifically labelled cofactors shows that both the equilibrating system and the 7-dehydrocholesterol reductase utilize the 4B-hydrogen atom of NADPH. In the light of these results a mechanism for the reduction of carbon-carbon double bonds is discussed.

LIPID METABOLISM IN THE TESTIS OF THE RAM. T. W. Scott and B. P. Setchell (I.C. Ross Animal Res. Lab., Prospect, Australia). *Biochem. J.* 107, 273–8 (1968). Analysis of ram testes revealed that phosphatidylcholine was the major phospholipid and accounted for about 40% of the total, with only small amounts of choline plasmalogen present. The ratio of phosphatidylcholine to choline plasmalogen in the testis was very different from that occurring in the spermatozoa, in contrast to the rat, where the ratio of the two lipids was very similar. Infusions of orthophosphate-^{32}P into the testicular artery of rams resulted in incorporation of radioactivity into most phospholipids, with phosphatidylinositol accounting for 68% of the radioactivity after a 3 hr. infusion. After the infusion of glucose-U-^{14}C, triglycerides accounted for 60% of the radioactivity in testicular neutral lipids and diglycerides for about 15%. Palmitic acid was the major component both in neutral lipids and phospholipids of ram testes.

FORMATION OF KETONE BODIES FROM PALMITATE-^{14}C AND GLYCEROL-^{14}C BY TISSUES FROM KETOTIC SHEEP. J. A. Taylor and H. D. Jackson (Purdue Univ., Lafayette, Ind.). *Biochem. J.* 106, 289–92 (1968). Labelled ketone bodies were produced readily from palmitate-U-^{14}C, palmitate-2-^{14}C and glycerol-1-^{14}C by sheep rumen-epithelial and liver tissues *in vitro*, with palmitate producing predominantly ketone and glycerol predominantly CO_2. These experiments confirm earlier observations that rumen-epithelial tissue, like liver, actively forms ketone bodies from long-chain fatty acids and show further that normal rumen-epithelial tissue can convert palmitate into ketone bodies as readily as into carbon dioxide. Free glycerol, which is metabolized only by liver tissue in non-ruminants, is also metabolized by rumen epithelium. The rumen epithelium thus has unique metabolic capacity among extrahepatic tissues.

FATTY ACID SYNTHESIS IN RAT ADIPOSE TISSUE. W. D. Duncombe (Wellcome Res. Lab., Beckenham, Kent, England). *Biochem. J.* 106, 179–83 (1968). The use of labelled acetate for studying the synthesis of long-chain fatty acids in rat adipose tissue *in vitro* has been examined, with special reference to the effect of acetate concentration. The incorporation of acetate into fatty acids is proportional to the concentration of acetate in the medium when the latter does not exceed about 10 μM. Above this concentration, the relative incorporation becomes progressively less, and reasons for this are discussed. In particular it is shown that this is not necessarily due to disturbance of the endogenous rate of fatty acid synthesis by a relatively large amount of acetyl-CoA derived from added acetate. However, to ensure that the added acetate does not cause such a disturbance its concentration must be kept sufficiently low. For labelled acetate used under present conditions, this concentration should not be more than about 10 μM.

THE LIPID COMPOSITION OF RAT BRAIN MYELIN AND SUBCELLULAR FRACTIONS DURING DEVELOPMENT. M. L. Cuzner and A. N. Davison (Charing Cross Hosp. Med. School, London, England). *Biochem. J.* 106, 29–34 (1968). The lipids of whole brain and subcellular fractions of the rat were analyzed during development. The deposition of cholesterol occurred in two phases, one related to increasing wet weight of the brain and the second to myelination. Cerebroside accumulation was related only to myelination. The composition of myelin isolated from 12-day-old rat brain was different in some respects from that of the adult. In the former there was an increase of phospholipid in relation to cholesterol and a marked deficiency in cerebroside. It is suggested that early myelin is extruded glial plasma membrane, which only later becomes mature myelin.

Acyl-coenzyme A. 1-Alkenyl-glycero-3-phosphorycholine acyltransferase action in plasmalogen biosynthesis. K. Waku and W. E. M. Lands (Dept. of Biological Chem., The Univ. of Mich., Ann Arbor, Mich. 48104). *J. Biol. Chem.* 243, 2654–9 (1968). Acylation of 1-O-(1′-alk-1′-enyl)-glycero-3-phosphorylcholine by long chain acyl thiol esters of coenzyme A to form plasmalogens was catalyzed by enzymes from erythrocytes and muscle. The alkenyl acyl phosphoglycerides produced were the type of plasmalogen most commonly present in mammalian tissues. Enzymes catalyzing this reaction are located in membrane fractions that also contain acyl transfer activity for other phospholipids. Acyl transfer rates with oleoyl-, linoleoyl-, and arachidonoyl-CoA were 13, 27, and 27 $m\mu$moles per min per mg of protein, respectively, with the acyl analogue that forms lecithin, whereas they were < 1, 9.4, and 4.7, respectively, with the alkenyl derivative that forms plasmalogen.

Fatty acid composition of lipid in the thoracic duct lymph of grazing cows. J. C. Wadsworth (Dairy Res. Found., Univ. of Sydney, Camden, New South Wales, 2570, Australia). *J. Dairy Sci.* 51, 876–81 (1968). The fatty acid composition of lipid fractions was studied in the thoracic duct lymph of three cows grazing on pasture. One cow (a three-year-old Ayrshire croos) was dry and the other two (a five-year-old Jersey and a four-year-old Guernsey) were in the second and sixth months of lactation, respectively. The composition of triglyceride in lymph samples collected at different times from the three cows were very similar. The major fatty acids in the triglyceride were 16:0, 18:0, and 18:1 which comprised, respectively, 22, 42, and 17% of the total. Plasma triglyceride had a similar composition. The major fatty acids of lymph phospholipid from one cow were 16:0, 18:0, 18:1, and 18:2 which formed, respectively, 17, 28, 13, and 24% of the total. Plasma phospholipid had a similar composition. Lymph cholesterol ester from the same cow contained predominantly 18:0, 18:2, and 18:3, which made up 15, 24, and 16%, respectively of the total fatty acids. The cholesterol ester of plasma contained higher proportions of 18:2 and 18:3 than that of lymph. A large number of minor components, principally branched-chain and odd carbon-number fatty acids, were found in approximately similar proportions in all lipid fractions.

Feed processing. III. Effects of ground, steam heated, and pelleted hay, with and without pelleted grain, on milk composition and rumen volatile fatty acid ratios. G. D. Thomas, E. E. Bartley, H. B. Pfost and R. M. Meyer (Depts. of Dairy and Poultry Sci., and Grain Sci., and Industry, Kansas State Univ., Manhattan). *J. Dairy Sci.* 51, 869–75 (1968). In a first experiment, hay was ground to three different degrees of fineness and fed to lactating dairy cows. The percent hay retained on Tyler sieves of size 16 or larger was coarse, 66.9; medium, 39.8; and fine, 0.9. Only finely ground hay depressed milk fat content (4.6 to 3.9%), decreased the percentage of rumen acetic acid (68.3 to 59.2), and increased the percentage of propionic acid (16.2 to 24.6). These changes occurred within the first seven weeks. In a second experiment, steam heating or pelleting the medium ground hay used in Experiment I did not influence milk yield, milk composition, or rumen volatile fatty acid concentration. In a third experiment, pelleted concentrates fed with pelleted medium ground hay depressed milk fat content only slightly when compared with unpelleted concentrates fed with the same hay.

Vitamin A-induced synthesis of alkaline phosphatase. P. A. Riley and R. I. C. Spearman (Dept. of Chem. Pathology, Univ. College Hospital Medical School, London, W. C. 1, England). *Science* 160, 1006–7 (1968). Incorporation of radioactive leucine into electrophoretically separated proteins from mouse tail epidermis indicates that synthesis of alkaline phosphatase is stimulated by vitamin A. It is suggested that some of the diverse effects of vitamin A may be the result of alkaline phosphatase induction.

Biosynthesis of a bacterial lipopolysaccharide. VI. Mechanism of incorporation of abequose into the O-antigen of Salmonella typhimurium. M. J. Osborn and I. M. Weiner (Dept. of Molecular Biology, Albert Einstein College of Med., Bronx, N. Y. 10461). *J. Biol. Chem.* 243, 2631–9 (1968). Enzymatic incorporation of abequose into the repeating unit of the O-antigen is catalyzed by the particulate cell envelope fraction of *Salmonella typhimurium.* The initial step is the formation of a lipid-linked tetrasaccharide intermediate according to the reaction cytidine diphosphate abequose + mannosylrhamonosyl-galactose-1-PP-lipid → abequosyl-mannosyl-rhamnosyl-galactose-1-PP-lipid. The tetrasaccharide-lipid intermediate has been isolated by extraction into chloroform-methanol, and the oligosaccharide moiety identified. Subsequent polymerization reactions lead to formation of O-antigen polysaccharide chains containing tetrasaccharide repeating units. Isolation of a lipid-linked oligosaccharide corresponding to a dimer of the repeating unit provides direct evidence that the growing O-antigen chain remains attached to lipid during polymerization. Evidence that the structure of the enzymatically synthesized polysaccharide corresponds to that of authentic O-antigen has been obtained by isolation and characterization of abequose-containing oligosaccharides following degradation of the polymers with periodate.

The molecular weights of porcine plasma high density lipoprotein and its subunits. A. C. Cox and C. Tanford (Dept. of Biochem., Duke Univ. Med. Center, Durham, N. Carolina). *J. Biol. Chem.* 243, 3083–7 (1968). The molecular weights of porcine plasma high density (1.1 to 1.2 g per ml) lipoprotein and its subunits were determined by sedimentation equilibrium. High density lipoprotein has a molecular weight of 210,000, of which 55% is protein composed of subunits of nearly identical or identical molecular weights: 28,000 to 29,000.

Nutritional aspects of thermally oxidized fats and oils. H. Kaunitz (Columbia Univ., New York, N. Y. 10032). *Food Technol.* 21, 278–82 (1967). In feeding studies with animals, toxic effects are observed with volatile decomposition products of oxidized fats, with products of fatty acid oxidation, and with cyclic monomers and non-adducting dimers; a lesser degree of toxicity, or none, is seen after feeding higher polymers, peroxides, or epoxides. Absorbed damaged fats may form free radicals and adversely affect enzyme systems and membranes; they may trigger the onset of certain diseases. Evidence on change in body fat is not conclusive, but increased organ weights and damage to heart and kidney tissue have been observed. The cooking operation apparently can improve the nutritional quality of the fat.

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• Drying Oils and Paints

THE ADSORPTION OF LONG CHAIN ACIDS ONTO RUTILE FROM N-HEPTANE. R. H. Ottewill and J. M. Tiffany (School of Chem., Univ. of Bristol, Bristol 8, Eng.). *J. Oil Colour Chem. Assoc.* **50**, 844–64 (1967). The adsorption of stearic, oleic, linoleic and linolenic acids onto rutile from n-heptane has been measured at temperatures of 5C and 25C, using dried materials. All the materials used were carefully characterized. Radiotracer methods using C^{14} labelled acids were employed to estimate the extent of adsorption at low equilibrium concentrations of adsorbate. With stearic acid a vertically oriented monolayer was obtained. With all the unsaturated acids stepped isotherms were obtained and these have been interpreted in terms of reorientation of the molecules on the rutile surface. Multilayer adsorption appeared to occur at high concentrations of unsaturated acids.

THE DEHYDROPOLYMERIZATION AND COPOLYMERIZATION OF DRYING OILS AND OTHER REACTIVE COMPOUNDS EXHIBITING α-METHYLENIC ACTIVITY. R. Lambourne (Res. Dept., Imperial Chem. Ind. Ltd., Paints Div., Wexham Road, Slough, Bucks, Eng.). *J. Oil Colour Chem. Assoc.* **51**, 310–23 (1968). The use of dialkyl peroxides to abstract hydrogen from molecules containing active methylene groups, followed by the combination of the free radicals so produced, is a useful way of carrying out controlled "polymerization," and has been termed "dehydropolymerization" or the "polyrecombination reaction." It has been found that the reaction provides a means of producing esters of unsaturated hydroxy acids directly from unsaturated fatty acids. The modification of drying and semi-drying esters by co-reaction with terpenes such as alloocimene and myrcene has been examined. The influence of structure on reactivity has been clearly demonstrated in the cases of alloocimene and myrcene. The former underwent the dehydropolymerization reaction normally, whereas the latter, containing a terminal $CH_2 = C -$, gelled under conditions favorable to dehydropolymerization, but could be used to "myrcenate" an oil using a catalytic amount of peroxide.

COMPOSITION AND FRACTIONATION OF TALL OIL. K. S. Ennor and J. Oxley (British Oxygen Chemicals Ltd., Chester-le-Street, Co. Durham). *J. Oil Colour Chem. Assoc.* **50**, 577–93 (1967). Crude tall oil, a by-product of the sulphate paper process, is fractionated into tall oil fatty acids, distilled tall oil, rosin, mixed saturated and unsaturated fatty acids, heads and pitch. The fatty acids are composed mainly of oleic and linoleic acids, whereas the rosin contains mainly abietic and dehydroabietic acids. Distilled tall oil is a mixture of fatty acids and rosin. Tall oil heads are of two types containing both saturated and unsaturated fatty acids with a large proportion of light unsaponifiables. Pitch contains mainly sterols, higher alcohols, esters and rosin. The process employs two columns which are operated under vacuum/steam fractionation conditions using a three-pass blocked system. Each pass produces a number of finished products, and intermediates from each pass become feeds for subsequent passes. An outline of the process is given together with a discussion of the function of the two columns.

AN INVESTIGATION OF THE REACTION BETWEEN LINSEED OIL AND PENTAERYTHRITOL. T. A. Cordwell (Joseph Mason & Co. Ltd., Derby, Eng.). *J. Oil Colour Chem. Assoc.* **50**, 615–623 (1967). The investigation entails the quantitative analysis by a thin-layer chromatographic method of samples from the reaction of linseed oil with pentaerythritol. It shows that optical density readings for separated and visualized components can be taken directly from the chromatoplate and indicates the most economical reaction time for the system examined.

• Detergents

SKIN CLEANSING COMPOSITIONS. I. Reich and H. Breuer (Carter-Wallace, Inc.). *U.S. 3,370,014.* A pressurized aerosol package for producing a coherent foam which breaks down on rubbing contains a liquid soap solution consisting of triethanolamine stearate (3%), refined mineral oil (10–20%) and water, and a liquefied propellant consisting of dichlorodifluoromethane (85 parts) and monochlorodifluoromethane (15 parts).

STUDY OF DETERGENCY. III. DETERGENCY AND ELECTRONMICROSCOPIC OBSERVATION OF NATURALLY SOILED CLOTH. Teruo Tsunoda and Yoichi Oba (Hitachi Central Research Lab., Tokyo). *Yukagaku* **17**, 303–8 (1968). The changes of soil removal efficiency of naturally soiled cloth with concentrations of detergents and builder were studied. The soil removal efficiency of around 70% was observed in case of washing with aqueous solutions of sodium tripolyphosphate only. The electron microscopic observations were carried out on fiber surfaces washed with washing solutions. Inorganic soil particles adhered strongly to the fiber surface levels corresponding to around 90% soil removal efficiency.

BIODEGRADABILITY OF ANIONIC SURFACTANTS IN AN EXPERIMENTAL CESSPOOL MODEL. R. Rismondo and F. Zilio-Grandi (Montecatini-Edison S.p.A., Porto Marghera, Italy). *Riv. Ital. Sostanze Grasse* **45**, 116–21 (1968). The biodegradation behavior of anionic detergents obtained from branched and straight-chain alkylbenzenes has been investigated under anaerobic conditions. The results indicate that degradation of branched alkylbenzene surfactants is, under anaerobic conditions, almost nil, and is not increased by increasing the retention time or the organic load. Anionic surfactants derived from linear alkylbenzenes, which are at least 80% degraded under aerobic conditions, degrade by at most 20% after 3–6 hrs. retention in anaerobic tanks, with only limited further degradation occurring after the initial period. Replacement of branched chain with linear alkylbenzene sulfonates is therefore not sufficient to guarantee the biodegradation of these organic surfactants when the biological treatment is conducted in anaerobic tanks.

SYNTHETIC DETERGENTS AND CULTIVATED SOIL. L. G. Federico (Univ. of Milan, Milan, Italy). *Riv. Ital. Sostanze Grasse* **45**, 108–15 (1968). Absorption experiments conducted with various commercial surfactants (dodecylbenzene sulfonate, lauryldimethylbenzylammonium chloride, nonylphenol ethoxylate) indicate that these substances are all rapidly absorbed by the ground, though in varying measure. The modification induced by the presence of these surfactants in some of the chemical, colloidal and biochemical properties of the soil have then been studied. Dodecylbenzene sulfonate, in particular, has been found to have a definitely negative effect on the colloidal and biochemical properties of the soil when present at very high concentration. The real surfactant content of soil irrigated with polluted water remains unknown, the analytical problems involved in such an evaluation being very complex.

THE DETERMINATION OF UNBRANCHED ALIPHATIC ALCOHOLS IN THE PRESENCE OF ALKYL BENZENES IN THE UNSULFONATED PORTION OF ANIONIC SURFACTANTS WITH THE AID OF UREA ADDUCTS. J. Kahovcova and M. Ranny (Fat Research Inst., Rakovnik, Czechoslovakia). *Tenside* **5**, 83–6 (1968). A method is described for determining unbranched aliphatic alcohols in the presence of alkyl benzenes in the unsulfonated portion of anionic surfactants. The method is based on the ability of fatty alcohols to form adducts with urea. The optimum conditions for the formation of adducts are statistically determined, as well as the effect of a molar excess of urea, the branching of the alkyl benzene and the chain length of the linear alcohol on the degree of conversion of the alcohol. The method enables the progress of the reaction between fatty alcohols and alkyl benzenes with sulfur trioxide to be followed and is also a method for checking on the presence of linear fatty alcohols in commercial products.

DEGRADATION EXPERIMENTS WITH ALKYL BENZENE SULFONATE IN THE OXIDATION DITCH. L. Huber (Bavar. Biol. Res. Inst., Munich, Germany). *Tenside* **5**, 65–76 (1968). The biological degradation of straight and branched chain alkyl benzene sulfonates in the oxidation ditch (a biological purification system in which substances remain for a long period of time)

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Classified Advertising

Microbes Aid Photographic Research

The use of microbes in photographic research was discussed by Dr. Charles T. Goodhue of Kodak Research Laboratories at a meeting of the Northeast Tennessee Section of the American Chemical Society held at East Tennessee State University, Johnson City, Tennessee.

In a technical paper on the "Microbial Transformation of Organic Compounds," Dr. Goodhue reported that microorganisms and their enzymes are being harnessed at Kodak to make chemicals that cannot be made economically any other way.

He cited several examples, one of which involved a new photographic developer. The developer, invented by Kodak, required a chemical intermediate that was prohibitively expensive. Kodak biochemists decided to try using microbes to produce the chemical intermediate.

They fed a very inexpensive chemical, similar to the one sought, to hundreds of bacteria until eventually one type learned to grow on it. The microbes completely digested the raw material but would not produce the desired intermediate. It was noticed, however, that a few of the microbial offspring didn't grow well on the raw material. Some were collected and put on a diet on which they could grow. Then they were fed some of the inexpensive material. This time they converted the material into the desired compound, yielding some 97% of it.

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was examined over periods of several years both before and after the change-over to easily biodegradable detergent raw materials. By modifying the contact period and the load as well as the method of metering, factors were determined which cause and limit biodegradation. Among the most important factors found were surfactant loading and contact time. In the normal range of low loadings found in oxidation ditches, tetrapropylene benzene sulfonate (TBS) and dodecyl benzene sulfonate are degraded to practically the same extent, namely over 80%. If the contact period is reduced and the surfactant loading is increased, dodecyl benzene sulfonate shows a clearly better degradation behavior than TBS.

The analysis of surfactants. I. The analysis of fatty acid monoethanolamide, a foam stabilizer. M. Mutter, G. W. van Galen and P. W. Hendrikse (Unilever Res. Lab., Vlaardingen, Holland). *Tenside* 5, 33–6 (1968). An analytical method is described for determining the composition of fatty acid monoethanolamide, a detergent raw material. In the method, the ionic components (monoethanolamine, cationic nitrogen impurities and fatty acids) are separated from the non-ionic components in a cationic-anionic exchanger and determined by titration. The non-ionic components are separated by column chromatography. The method has good reproducibility.

II. Analysis of fatty acid monoethanolamide-ethylene oxide condensate, a non-ionic surfactant. *Ibid.*, 36–9 A method is described for the analysis of fatty acid monoethanolamide/ethylene oxide condensates in which the ionic components are separated by means of cationic and anionic exchangers arranged in series, while the non-ionic components are separated by means of reversed-phase column chromatography with silanated silica gel, followed by titrimetric and gravimetric determination.

Phosphorus-induced eutrophization of inland waters. R. A. Vollenweider (Ital. Inst. of Hydrobiology, Pallanza, Italy). *Riv. Ital. Sostanze Grasse* 45, 99–107 (1968). Inland water eutrophization, particularly of lakes, can be considered as one of the various aspects of water pollution, manifesting itself through excessive growth of algae and macrophytes near the surface of the water, progressive exhaustion of oxygen in the deeper layers and disappearance of fish life. Excessive supply of nutrients, from agriculture and from waste waters, are direct or indirect causes of this development. Phosphorus compounds, which are contributed to the extent of 20–50% of the total by detergents, have been shown to be of particular importance.

Epichlorohydrin as a basic material for strongly foaming surfactants. C. Kortland and C. Borstlap (Shell Research N.V., Amsterdam, Holland). *Tenside* 5, 43–4 (1968). The sulfonates of glycidyl esters of branched synthetic carboxylic acids and of alkyl glycidiyl(thio)ethers derived from primary alcohols, secondary mercaptans and linear alkylphenols are high-foaming detergents, whose foam stability under dish-washing conditions exceeds that of fatty alcohol ethoxy sulfates. Comparative experimental results on foam stability of these various surfactants are reported.

The effect of the mole ratio of fatty acid methyl esters to sucrose on the formation of sucrose mono-, di- and triesters. M. Ranny, J. Haumer and J. Novak (Fat Res. Inst., Rakovnik, Czechoslovakia). *Tenside* 5, 40–2 (1968). A study of the reaction between sucrose and fatty acid methyl esters in dimethyl sulfoxide indicates that the composition of the resultant mixture of sucrose fatty acid esters depends not only on the molecular ratio of the starting components, but also on the rate at which the methanol formed is removed.

Contribution to the study of the properties of polyethylene glycol esters of industrial fatty acids, I. G. Geipel, F. Wolf and K. Löffler (Univ. of Halle, East Germany). *Tenside* 5, 132–7 (1968). Experimental results on the physico-chemical and surface-active properties of polyethylene glycol esters of various industrial fatty acids are reported as a function of the number of ethylene oxide groups in the molecule. The study was directed mainly at obtaining data not generally available in the technical literature concerning these compounds.