Industrial Fatty Acid Registration under way

More than three dozen speakers from industry, government and academic institutions will provide the latest available information on industrial fatty acids – from raw materials to end uses – during the AOCS Short Course on Industrial Fatty Acids to be held June 10-13, 1979, at Tamiment Resort and Country Club in Tamiment, PA.

The registration fee of $285 includes a double-occupancy room and meals from supper on Sunday, June 10, through breakfast on Wednesday, June 13. The course is designed to be of value to beginners in the field as well as to stimulate veteran workers. A registration card is included in this issue of *JAOCS:* Additional cards are available from AOCS, 508 S. Sixth St., Champaign, IL 61820 USA.

Dr. N.O.V. Sonntag, technical director for Southland Corporation Chemical Division in Dallas TX, is program chairman. Local chairman is Dr. G. Maerker, chief of the Animal Fat Laboratory at the USDA's Eastern Regional Research Center in Philadelphia, PA. The program will begin after supper Sunday, then continue mornings from 8 a.m. until 2 p.m., resuming after supper for about two hours each evening. The course will conclude about noon on Wednesday, June 13. Afternoons will be free for golf, tennis, swimming or any of the varied recreational activities available at Tamiment.

Abstracts for approximately half the technical papers follow. A brochure outlining the full course is available from AOCS; additional abstracts will be published in April.

Animal Fat Raw Materials. G. Maerker, USDA, Eastern Regional Research Center, Philadelphia, PA.

Tallow and grease, by-products of the meat industry, are source materials for more than half the industrial fatty acids produced in the United States. The sources, characteristics, and U.S. and world production and disposition of these animal fats will be discussed. Tallow has a relatively high degree of saturation and is the principal source of stearic and palmitic acid. The chemical compositions of tallow and other animal fats will be discussed with regard to fatty acid profiles and compared to those of principal vegetable oils. The fatty acids occur in animal fats (as well as in vegetable oils) principally as triglycerides, but there are numerous other chemical components of animal fats, some of which contain fatty acids, while others do not. A brief description of the less plentiful components of animal fats will be given.

Background, Importance and Production Volumes. J.C. Kern, Fatty Acid Producers Council, New York, NY

The historical background leading to the present state of the fatty acid industry will be traced through the main pioneering developments. The 1978 U.S. production and disposition figures for fatty acids and comparison with earlier years as compiled and reported monthly and annually by the Fatty Acid Producers' Council will be categorized and summarized. Factors which illustrate the importance of the fatty acid industry and the economic aspects will be discussed.

Esterification and Interesterification. N.O.V. Sonntag, Southland Corporation Chemical Division, Dallas, TX.

Since the original direct esterification in 1855 by Pelouze and Geles of glycerol with butyic acid, both these chemical reactions have been developed to the state where they constitute collectively today the most widely used methods for the production of fatty acid derivatives. The versatile and large group of fatty acid esters are prepared from monoalcohols (C_1 to C_{20} members), glycols (ethylene and propylene glycols and others), etherglycols (many polyoxy-ethylene glycols), triols (glycerol and others), tetraols (pertaerythritol, etc.), polyglycerols and many carbohydrate materials (sorbitol, sobiton, sucrose). The catalyzed and noncatalyzed direct esterification of monoalcohol glycols and glycerol with fatty acids will be outlined. Innovations in direct esterification will be explored. Examples of interchane esterifications such as methyl ester and monoglyceride production from fats and oils will be detailed. Certain versatile production equipment and typical industrial-scale production operations in both esterification and interesterification will be detailed.

Ethoxylation. G.J. Stockburger, ICI Americas Inc., Wilmington, DE.

The translation of the potentially hazardous, highly exothermic alkoxylation reaction to the rapid, safe and completely reliable industrial technology that it is today has been a noteworthy development. In this paper the reactions of ethylene oxide with fatty acids in the presence of alkaline catalysts at temperature above 100 C will be critically examined. The two-step nature of this reaction will be elucidated. The complexity of the reaction demands intricate and sophisticated equipment for successful transflation to production-scale operation.

Fat Splitting. N.O.V. Sonntag, Southland Corporation Chemical Division, Dallas, TX.

Although fatty acids can be obtained from fats and oils by other methods (for example, saponification, followed by acidulation), fat splitting, particularly the high pressure continuous countercurrent hydrolysis of fats and oils, represents the technological cornerstone for today's American fatty acid industry. The various methods of hydrolytic fat splitting, batch vs. continuous, catalyzed vs. noncatalyzed, will be compared to illustrate the variety of techniques that are available. General splitting conditions will be outlined with respect to (a.) maximum unsaturated with minimum polymerization, (b.) temperature-pressure correlations, (c.) velocity of hydrolysis, (d.) completeness of splitting attainable, and (e.) other factors. New aspects of enzymatic hydrolysis will be treated with a view to the potential production of polyunsaturated fatty acids. Specificity in enzymatic hydrolysis will be reviewed.

Federal Regulations Applicable to the Fatty Acid Industry. I.A. MacDonald, Ashland Chemical Co., Columbus, OH.

Recent legislation including: The Clean Air Act, The Clean Water Act, The Occupational Safety and Health Act, The Solid Waste Disposal Act, The Resource Conservation and Recovery Act, and especially, The Toxic Substances Control Act, is having great impact on chemical manufacturers. The burgeoning maze of rules, regulations and policy statements implementing these acts impose serious obligations on all those engaged in fatty acid manufacture, processing, distribution and research and development. The Manufacturing and Processing Notices – Sec. 5 and Reporting and Retention of Information – Sec. 8, requirements of TSCA requires extensive recordkeeping and reporting, and will affect industry's development of new products and significant new uses of products. The status of the listing of fatty chemicals on the inventory of existing chemicals and the effects of the SDA procedures for listing on premanufacture notification will be presented in some detail along with the discussion of the proposed premanufacture notification rules. Other impending regulations will be discussed as appropriate.

Fractional Distillation. W. McPherson and R. Berger, EMI Corporation, Des Plaines, IL.

While practically all of the fatty acids produced in the fatty acid industry are distilled products, these materials are all, at least to some degree, fractionated fatty acids. Rarely indeed are today's fatty acids suited for any of the many applications to which they are put without the quality and homolog distribution improvements which only fractional distillation can guarantee. Thus, this separation is of vital importance within the fatty acid and derivative industry. Fractional distillation as a practical separative method for: (a.) 16:0 and 18:0 fatty acids such as those derived from hydrogenated fats and oils such as tallow, soybean, cottonseed soapstocks, palm oil and others; (b.) 18:0, 20:0, 22:0 and 24:0 fatty acids from hydrogenated fish oils or high erucic rapeseed oil; (c.) 8:0, 10:0, 12:0 and 14:0 fatty acids from the hydrogenated fatty acids from the lauric acid group (coconut, palm kernel, babassu, etc.) will be treated in detail. Some new developments in still and fractionated column equipment will be indicated.

Hydrogenation. R.C. Hastert, Harshaw Chemical Co., Beachwood, OH.

Catalytic hydrogenation is a vital process for both the edible fats and oils and the industrial fatty chemical industries. This paper will explore the similarities and differences between fat and oil and fatty acid hydrogenations in equipment, processing conditions and catalysts employed. The specific effects of variables (agitation, pressure, temperature and feedstock quality) on fatty acid hardening will be examined. Current and projected design of converters and auxiliary equipment to achieve the maximum in energy and labor efficiency will also be explored. There will be a brief discussion of nitrile to amine hydrogenation, linking this unit operation to the specific field of fatty acid nitrogen derivatives.

Interrelationships in Fatty Acid Processing. E. Fritz, Union Camp Chemical Division, Savannah, GA.

The choice of operating conditions for any of the several unit operations of hydrogenation, fat splitting, fatty acid separation or fractional distillation for the production of quality fatty acids critically depends upon what has been done beforehand and what is to be done later in the sequence of processing steps. Many interrelationships that prevail in this sequence will be outlined, and the overall effect of these on the quality of finished products and overall processing efficiency will be indicated. For example: the use of catalysts in fat splitting is known to affect the residue from fatty acid fractional distillation; incomplete splitting not only results in low glycerol yields, but reduces the yield of fatty acids in distillation; selective hydrogenation of tallow feedstocks before splitting sometimes changes the physical properties of solvent-separated oleic acids; incomplete removal of nickel catalyst in fatty acid hydrogenations affords undesirable effects during subsequent distillation. If these factors are not controlled, overall serious quality and efficiency problems could easily occur.

Materialsof Construction in the Fatty Acid Industry. E.E. Rice, HumKo-Sheffield Chemical, Memphis, TN.

Materials of construction together with design and process criteria are the factors that permit the translation of these chemical reactions carried out in the fatty acid industry to an industrial scale reality. The several metals including the 304 and 316 series of stainless steel, certain specialized alloys such as Inconel, Monel, Carpenter 20Cb, and aluminum all have specific uses. The strength and rates of conversion under a wide variety of alkaline, neutral, and acid-operating conditions, the need to limit undesirable iron and copper contamination, plus the ability to withstand pressure operations are three desiderata required in the selection of appropriate metals of construction. Many organic materials such as fiberglass-polyester tankage and applied linings of the phenolic or the epon-epoxy type now have achieved limited usefulness. This presentation affords an up-to-date review of this subject. Previously, recommendations for the use of certain materials of construction suited for the requirements of the fatty acid industry have been largely based upon the outdated information circulated and distributed by the old Fatty Acid Division of the Association of American Soap and Glycerine Producers, Inc., in the 1940s.

Methyl Esters in the Fatty Acid Industry. R.D. Farris, Industrial Chemicals Division, The Procter & Gamble Co., Cincinnati, OH.

Methyl esters are being used as alternate raw materials for the production of a whole series of derivatives presently made from fatty acids. These esters are increasingly being used in fractional distillations where their advantages over fatty acids include better thermal stability, lower boiling points, and larger differences in boiling points between homologs. The most common industrial process for making methyl esters will be reviewed briefly. Their use as raw materials for the production of fatty alkanolamides for detergent and cosmetic applications will be outlined. Finally, the prospects for methyl esters as feedstocks for synthesizing other derivatives will be explored.

New Fatty Acids from Outer Space. H. Brown, Finetex, Inc., Elmwood Park, NJ.

A recent space exploration has revealed that matter attains a state of complete weightlessness in the far reaches of outer space. Herman Brown, reporting on his latest spaced out venture, indicates that weightless fatty acids obtained from the Superba Galaxy are ideally suited for the manufacture of improved food additives. What a magnificent way to provide the diet-control foodstuffs of the 21st century!

Physical Properties of Fatty Acids. F.E. Luddy USDA, Eastern Regional Research Center, Philadelphia, PA.

Few series of compounds have been as thoroughly investigated as the saturated fatty acids and several of their simple derivatives such as methyl esters and amides. Information on the unsaturated fatty acids is somewhat less extensive, possibly because of the relatively recent availability of these materials in high purity. The major physical properties of the common saturated and unsaturated fatty acids will be related to chemical structures. Thermal properties of fatty acids and the phase behavior of binary mixtures of saturated-unsaturated fatty acid systems will be emphasized. The historic commercial use of thermal data (i.e., melting behavior) to indicate composition will be illustrated with palmitic-stearic fatty acid mixtures.

Separation of Fatty Acids. K.T. Zilch, Emery Industries, Inc. Cincinnati, OH.

This presentation will include the technology employed within the fatty acid industry for the separation of fatty acids exclusive of fractional distillation (covered in a separate paper). The methods to be discussed will not only include separation presently being practiced on a commercial scale and in smaller pilot plant operations, but also those methods employed for analytical or scientific purposes in the laboratory as well as the newer but not yet developed methods of separation. Relative to these methods we will evaluate the separation of saturated acids from unsaturated acids, monounsaturated acids from polyunsaturated acids, and linear acids from nonlinear acids.

The Soya Reversion Problem. T.H. Smouse, Ralston Purina Co., St. Louis, MO.

Soybeans were first introduced to the American farmer in the early 1920s as a crop to help reduce the surplus wheat harvests. Although at first soybeans were slow to be accepted, their production rapidly grew to its position today as the most important oilseed crop in the United States. Soybean oil has been utilized in both industrial and edible products. Its use will continue to increase as the problem of flavor reversion is minimized. Crude soybean oil has a characteristic "green-bean" flavor which during refining, bleaching, and deodorization is eliminated to produce a bland tasting, light colored oil. However, flavor returns during storage and has been characteristically called the "reversion flavor" of soybean oil. This deleterious characteristic flavor has reduced the utilization of soybean oil and its fatty acids. Several theories for the cause of "reversion flavor" will be presented and briefly reviewed. Studies and progress made in the last ten years will be critically evaluated. Methods for reducing the rate of "reversion flavor" formation will be outlined. The methods will include processing steps as well as the use of various additives and techniques which are being used to reduce "reversion-flavor" development. Present research is being conducted in several research facilities in anticipating that eventually the problem of soybean flavor reversion will be completely eliminated.

Toxicological, Bacteriocidal and Fungicidal Properties of Fatty Acids and Some Derivatives. J.L. Kabara, Michigan State University, East Lansing, MI.

The LD_{50} oral ingestion values for the common commercial fatty acids are in the range which are considered nontoxic; 24-hour primary skin irritation is considered positive for octanoic acids but negative for decanoic acids upward; the skin corrosivity is considered positive for decanoic acids and lower, negative for lauric acid and higher; eye irritation is considered positive for lauric acid and lower, negative for myristic acid and higher. Bacteriocidal and fungicidal properties for the common fatty acids and certain salts will be outlined and a number of unusual effects noted. Certain derivatives of fatty acids, such as high purity monoglycerides, have unprecedented activity.

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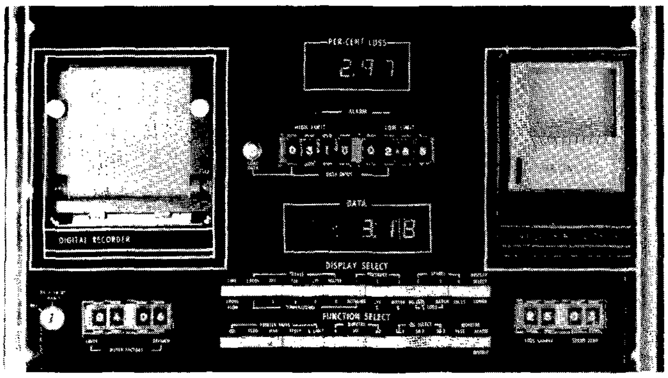

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