ABSTRACTS OF PAPERS
1966 SHORT COURSE
MICHIGAN STATE UNIVERSITY
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R. D. Good

RAW MATERIALS—HANDLING AND CONTROL

R. D. Good

The principal raw materials for the oilseed industry in the United States are soybeans, cottonseed, safflower and flaxseed. (Corn germ, another principal source of vegetable oil will not be discussed because it is not a raw material in the same sense as the oil seeds.) Handling and control of these raw materials, in common with many agricultural products, are characterized by a short harvest season, by the necessity to move the crop into protected storage in minimum time, and by the required care for the seeds or beans until they can be processed. Unlike other more perishable agricultural products such as fruits and vegetables, the oilseeds can be successfully stored with minimal deterioration for many months if proper storage control is exercised. This fact allows the processing industry to operate throughout most of the year. Modern equipment for oil seed transporting, receiving, cleaning, drying, storing, and protecting against undue damage are discussed.

R. W. Bates

CONTINUOUS HIGH AND LOW *RENDERING*

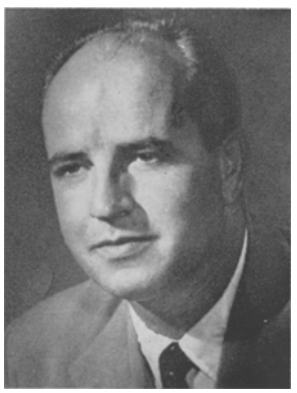
R. W. Bates

The history of rendering will be given and the many methods of rendering used throughout the years will be described.

Conventional methods of rendering will be discussed and their effect upon fat quality. These will include dry, wet, and solvent extraction of tissues.

The newer continuous, low and high temperature methods will also be described in some detail.

Quality specifications of rendered materials will also be discussed.



F. E. Sullivan

CONTINUOUS REFINING

F. E. Sullivan

The technique of continuous refining of oils and fats has steadily improved since the first commercial installation some thirty years ago. Refining is the most important economic factor in the overall processing of an oil from the crude to the finished product.

Crude oil handling, reagent selection, mixing, heating and centrifugal separation are all critical when attempting to obtain the maximum refining efficiency. The agronomist, scientist, control lab, operating personnel along with the equipment manufacturers have all aided in obtaining more efficient and economical processing methods.

When discussing the overall refining process, soapstock handling must also be considered. In recent years several successful continuous soapstock acidulation plants have been installed. With this addition to a refinery, the refining operation can now truly be considered as a continuous process. Similar to most industrial processes, this has been an evolution from the batch system to a semicontinuous system up to the present continuous treatment of soapstock and wash water to produce a high purity acid oil on an economical basis.

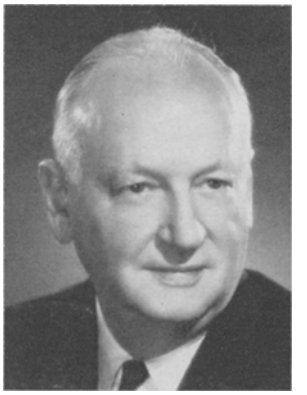
Details of the various factors in refining and acidulation on a commercial basis along with control methods will be discussed.

R. P. Hutchins

PROCESSING CONTROL OF CRUDE OIL PRODUCTION FROM OIL SEEDS

R. P. Hutchins

Control of oil seed processing for best quality and yield requires attention to many details starting at the seed unloading station and continuing through to the loading of products. The continuous mechanical screw press process and the solvent extraction process have many common problems involving quality and yield control. Time, temperature and moisture are the variables involved in all the unit processes comprising oil seed milling. These unit processes and some recent developments in low temperature processing are described. Oil seed milling is still "rough terrain" with regard to automation, but labor costs as a percentage of total processing costs are relatively low in large capacity plants.



A. D. Rich

EFFECT OF THE THREE MAJOR FACTORS THAT INFLUENCE BLEACHING PERFORMANCE

A. D. Rich

(I) Effect of Clay Type

1) Purpose of clay in industry, raw material source, clay types, physical structure, effect of activation on structure, variation in effectiveness of clays produced from different raw materials, mechanism of clay's action.

2) Effect of clay's properties-moisture, ABD, specific gravity, acidity, pH, hydrated silica, particle size distribution.

3) Theory of variability.

(II) Effect of Bleaching Method

1) Effect of bleaching conditions—bleaching temp., time, agitation, temp. of clay addition, vacuum vs. atmospheric bleaching.

2) Commercial methods used—atmospheric batch, vacuum batch, vacuum continuous.

(III) Effect of Oil Quality

1) Response of different color pigments to bleaching
2) Effect of moisture in the oil
3) Effect of oxidation in the oil
4) Effect of organic impurities in the oil

C. E. McMichael

DEODORIZATION—PRINCIPLES AND PRACTICE

C. T. Zehnder and C. E. McMichael

Deodorization of fats is a steam stripping operation in which the undesirable, volatile components are stripped from the oil with steam. The process pretty closely follows Raoult's law; however, the fat-fatty acid system is not an ideal solution. The several factors affecting the efficiency of deodorization, i.e., time, temperature, pressure, stripping steam rate, etc., are discussed.

The practice of deodorization is carried out in three general types of equipment: 1) batch, 2) continuous, and 3) semi-continuous. Several types of deodorizers in each of the first two broad categories are described. The semi-continuous system is also described. The improvements in materials of construction, fabrication, vacuum equipment and heat-transfer have contributed largely to the improvements in equipment and the process.

The recovery of overheads is practiced by 1) a simple knock-out drum, 2) a condenser served with tempered water, 3) a system in which barometric water is recirculated, 4) a system in which a fat is recirculated, and 5) the actual skimming of fats from the hot well and catch basin used in conjunction with standard barometric condensers. Each system is briefly discussed.

Precautions required to protect the oil against deterioration in the process are discussed.

E. L. Ralston

PROCESS CONTROL CONCEPTS

E. L. Ralston

Many technical phrases are used rather loosely today when describing the interplay between computers and processes. These phrases are defined and their intended meaning made clear by the use of examples.

Also to be considered are the philosophy behind the use of computer control over a generalized process, the levels of sophistication in applying computer control and the characteristics which make a process suitable for computer control.

In conclusion, several examples are given in detail to show the various ways justification for computer control has been established.

R. R. Allen

PRINCIPLES OF AND CATALYSTS FOR HYDROGENATION

R. R. Allen

The hydrogenation reaction is the most important chemical reaction in the fat and oil industry. It is also perhaps the least understood.

The most critical factor in the reaction is the catalyst. Several different types of metal catalysts can be used. The reaction conditions as well as other factors determine the type of product produced. However, all the factors can be related to effects on the catalyst.

The "selectivity" concept of catalyst evaluation is not new. However, the term has come to have several different meanings. It is believed the term should be used only for chemical selectivity which can be easily determined. The "selectivity ratio" number is very useful and can be used to judge the performance of a catalyst.

M. Eijadi

HYDROGENATION PROCESS OF FATS AND OILS

M. Eijadi

I. The history of hydrogenation and a brief reference to marketing of hardened fats.
II. The principal factors involved in selective and non-selective hydrogenation.
III. Operating procedure to be conducted for hydrogenation of vegetable, animal and marine oils, which are as follows:
  A. Quality and kinds of oil
  B. Quality of hydrogenation gas
  C. Processing and required specifications of edible oils, prior to hydrogenation.
  D. Pretreatment of low grade greases, acid oils, fish oils and fatty acids.
  E. Various types of hardening systems, used in Fat and Oil plants throughout the world, covering dead-end, gas circulating, oil and catalyst circulating, and continuous hydrogenators.
F. Preparation of hydrogenating vessel and sequence of operation:
  1. Charging
  2. Pre-heating
  3. Starting and operating temperatures
  4. Hydrogenation cycle, gas pressure, consumption of most effective method of hydrogenation gas sparging.
  5. Methods controlling the end points
  6. Utilizing heat of reaction in cooling cycle.
  7. Filtering metallic impurities and post bleaching.

L. H. Going

INTERESTERIFICATION—PROCESSES AND PRODUCTS

L. H. Going

Interesterification as applied to fats and oils is a process whereby the fatty acid moieties of glyceride molecules are rearranged in a random or directed manner. Either type or rearrangement may involve production of new triglyceride compositions in a predictable manner.

A number of patented processes for accomplishing interesterification will be discussed. Effective rearrangement catalysts will be listed. Typical applications to commercial products will be reviewed.

C. W. Hoerr

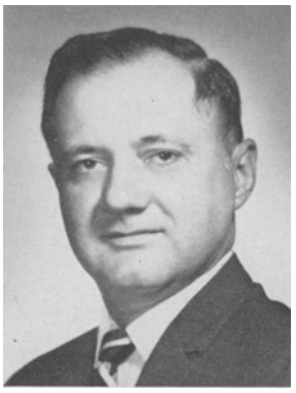
EFFECT OF PROCESSING ON CRYSTAL STRUCTURE

C. W. Hoerr

The performance of fats in many of their uses in food products is directly dependent on their crystal structure. Fats exist in several crystal modifications each of which exhibits physical properties which influence the behavior of the fat differently in various applications. For example, certain crystal forms of fats provide the desired volume and texture of bakery products, whereas other crystal forms do not perform satisfactorily in this application; crystal forms which fail to produce satisfactory baked goods may perform superbly in whipped toppings.

The crystal forms in which fats exist and their rates of transformation from one modification to another are dependent upon their molecular composition and configuration. Processing procedures such as blending, hydrogenation, interesterification, fractionation, etc., markedly alter the molecular composition and configuration.

Other processing such as votating and tempering practices directly affect the crystal structure of the products. Thus, through judicious choice of processing procedures we can govern the crystal characteristics of products to obtain the desired performance in specific applications.



E. G. Latondress

HYDROGENATION AND BLEACHING CONTROL PROCEDURES

E. G. Latondress

A brief description of various hydrogenation control tests including refractive index, congeal points and Wiley melting points will be given, followed by a discussion of how these analyses are used to control the production of hydrogenated oils meeting certain specifications.

The purpose of various bleaching operations will be discussed. This will include a discussion of the degree of color reduction necessary in various stages of bleaching to meet specific customer final color requirements.

L. H. Wiedermann

MARAGARINE OIL FORMATION AND CONTROL

L. H. Wiedermann

The continued increased margarine production in the United States and around the world indicates the importance of this product as a significant food item. This growing acceptability is due in large measure to the improved performance characteristics of today's margarine products. Since certain important characteristics of finished margarines are dependent upon the physical properties of the fats and oils used in these products, it is important to consider these factors and their environmental response, e.g., to crystallization, tempering, etc., in the blending and formulation of margarine oils.

The choice and control of an oil blend and its components, available from a variety of sources and treatments, in today's margarine products is concerned with crystal structure, hardness, solids content and solids distribution as measured by NMR, solid fat indices, dilatations and other melting characteristics. The relationships between these properties and product "consistency," as affected by margarine processing methods, is discussed in terms of this choice, using finished margarine testing methods to illustrate these influencing factors.

The special oil blend requirements of commercial, military and "health" margarines are also presented, as are the oil blending practices for margarines manufactured in countries other than the United States.

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(Continued from page 308A)

T. J. Weiss

SALAD OIL MANUFACTURE AND CONTROL

T. J. Weiss

Cottonseed salad oil is normally prepared by winterization, a process whereby oil is chilled slowly to form crystals of disaturated triglycerides which are then removed by filtration. Hydrogenated soybean oil is similarly processed. Unhydrogenated soybean, corn and safflower oils do not require winterization. A recent approach is to winterize from solvent, resulting in increased salad oil yield. The main control method is the cold test, a measure of the time required for the oil to cloud in an ice bath. Crystal inhibitors such as oxystearin or polyglycerol esters, are used to lengthen the cold test.

D. R. Erickson

FINISHED PRODUCT TESTING

D. R. Erickson

Testing of finished edible fat and oil products will be reviewed from the standpoint of chemical analyses and performance testing in bakery products.

David Firestone

METHODS FOR DETERMINING CONTAMINATION OF FATS AND OILS

David Firestone

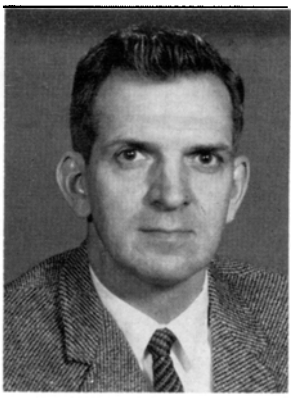
Practical gas chromatographic methods for detection of pesticide residues, chick edema factor, and foreign fats in fats and oils will be discussed. Techniques for detection of animal fats in vegetable fats and for identification of individual fats and oils will be reviewed. Suitable cleanup techniques as well as required gas chromatographic systems will be surveyed, and the specificity and sensitivity of each procedure will be indicated.

G. R. Maher

AIR POLLUTION CONTROL OF STATIONARY SOURCE EMISSION OF ORGANIC SOLVENTS—LOS ANGELES COUNTY RULE 66

G. R. Maher

In an effort to further their control of sources emitting organic solvents into the atmosphere, the Air Pollution Control District of Los Angeles County, California, plans to have Rule 66 passed into law during July, 1966. Rule 66 specifically relates to the control of organic solvent emissions from stationary sources. This paper directs itself to a discussion of the technical aspects used by the Air Pollution Control District in establishing which organic solvents contribute most significantly to the formation of photomechanical smog, eye irritation and ozone. It also draws attention to the very specific topography of Los Angeles County. And it suggests that air pollution control authorities elsewhere be made cognizant of this in establishing controls on organic solvent emissions in their locatities, so as not to be unnecessarily harsh and restrictive. In addition it covers a report on continuing industry-sponsored research, aimed at establishing better test methods and scientific knowledge regarding photochemical reactivity, upon which future control legislation might be based.



E. R. Sherwin

METHODS FOR STABILITY AND ANTIOXIDANT MEASUREMENT

E. R. Sherwin

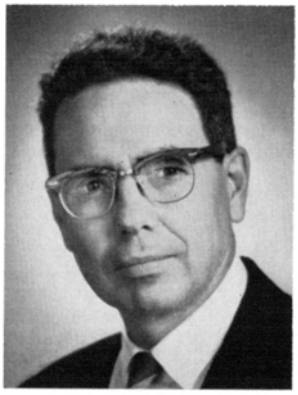
Basic physical and chemical characteristics of commercially available fats, oils, and antioxidants upon which stability tests and antioxidant analyses are dependent will be reviewed briefly. With these chacteristics in mind, the techniques of stability and antioxidant measurement will be discussed. Particular emphasis will be placed on the methods more commonly being used in product development and quality control.

H. J. Dutton

DETERMINATION OF FAT COMPOSITION

H. J. Dutton

A revolution has taken place in the analysis of fats. Physical methods both rapid and accurate have replaced laborious chemical procedures. The time-honored saponification equivalents and iodine values now are calculated from chromatographic and nuclear magnetic resonance spectroscopic data. Differential migration processes such as countercurrent distribution, liquid-liquid chromatography, and gas chromatography have supplanted the classical distillation and crystallization procedures for analysis and preparation. What have been referred to as "gadgets" are now the stock-in-trade of the analytical lipid chemist. Mass, infrared, ultraviolet, and nuclear magnetic resonance spectrometers are the accepted tools for organic characterization. Recording detectors and computer processing of data reduce the labor of analysis and improve its quantitation. Today's methodology stands at the verge of specifying fatty acid composition of even so complex lipids as hydrogenated fats, in terms of the amounts, the positions and geometric configurations of its individual component fatty acids.



E. S. Welch

CLEANED IN PLACE (C.I.P.) SYSTEMS AND CONTROLS

E. S. Welch

This will be a discussion of how C.I.P. relates to *control* of plant operation, sanitation and operating costs. Slides will show typical layout and design. There will be photos of existing installations. Some of topics covered will be: How C.I.P. Relates to Basic Elements of Cleaning; Other Methods of Cleaning; Process Equipment; Process Layout; Process Control; Labor Relations; Quality Control; Cleaning Control; Cleaning Costs; Plant Operating Costs.

H. P. Andrews

STATISTICAL PROCESS AND QUALITY CONTROL

H. P. Andrews

Statistics has contributed much to the control of the quality of manufactured product since Shewhart's famous publication in 1931. Today *S*tatistical *Q*uality *C*ontrol to many people means the full utilization of the techniques of applied statistics to problems of ACHIEVING, MAINTAINING, and IMPROVING the quality of industrial products and processes. This paper will present the "broad-spectrum" contributing role of statistics in industrial processing with particular emphasis on experimentation for process study and improvement.

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R. Thomas

MISCELLA REFINING

R. Thomas

The miscella refining process is most economically done at the crushing mills.

It has other advantages such as:

1) Production of lighter colored oil, light enough that some salad oil processors do not need to bleach.
2) Lower operating cost, with smaller investments, less power and labor.
3) Greater yields of refined oil.
4) More effective removal of F.F.A. and low refining loss.

It is not unusual to operate at these levels with miscella refining:

F.F.A	0.02
Color	4.2
Bleach	0.95
Moisture	0.06
Soap PPM	0.15

EMULSIFIERS: PROCESSING AND QUALITY CONTROL

Ira A. MacDonald and H. M. Truax

I. A. MacDonald

I. Characterization and Processing

Emulsifiers are surface-active agents (surfactants) which are added to an emulsion to increase its stability by interfacial action. They are divided into two broad categories, ionic or nonionic, according to the character of their colloidal solutions in water. As an eclectic guide to emulsifiers considered pertinent to the AOCS, greatest emphasis is placed on the description and processing of the nonionic type and only representative examples of the three classes of ionic surfactants, i.e., anionic, cationic and amphoteric will be considered.

Nonionic types discussed in more detail include: polyol-fatty acid esters of glycol, glycerol, polyglycerol, tetritol and pentitol, hexitol, anhydro hexitols and sugar, as well as the polyethanoxy and polylpropanoxy esters and ethers.

II. Controls

Common analytical procedures, i.e. acid number, saponification number, hydroxyl number, etc. and their significance are described.

A combined statistical-chemical control program plays an important role in assuring batch to batch emulsifier uniformity. Consistent emulsifier performance is obtained by mating raw material acceptance plans, in-process control, and final product qualification. All of these elements are required for an effective program. Statistical Q.C. techniques maximize control benefits of chemical analysis. Newer analytical methods such as automated GLC increase the sensitivity of control decisions.

J. M. Goldman

COMMODITY TRADING: MARKETING AND THE USE OF THE FUTURES MARKET

J. M. Goldman

I. Introduction

II. Role of Chemist
- A. Greater acceptability of SBO salad oil in recent years—improvement in quality.
- B. Moves to convert vegetable protein in acceptable form for human consumption.

III. Role of Marketing Man—Both Cash and Futures With Emphasis on Futures
- A. Three variables for cash man.
- B. Futures offer added areas to express market judgment.
- C. Aspects coming into play in analysis and price determination of soybean complex.
- D. Brief summary of current year's prices of soybean complex and crush according to meal demand rather than oil demand and how they were determined.

IV. Importance of Conversion—Spread Between Soybean Prices and End Products
- A. U. S. Crushing capacity.
- B. Processor interest in price relationships.
- C. Board conversion and "minus" conversion.
- D. Crushing costs.
- E. How processors use futures markets to "fix" conversion margins.
- F. Factors that influence the spread.

V. Conclusion

• *New Literature*

CHEMICAL ECONOMIC SERVICES has just published the *Executive Directory of the U. S. Pharmaceutical Industry (1966)*, the first edition of a planned annual refernce work. This is the only directory of its kind, listing 465 companies and over 3,000 executives. Also included are boards of directors, subsidiaries and divisions, annual sales (if available) and products. Price, $21. (Nassau Street and Palmer Square East, Princeton, N. J.)

KAMAN NUCLEAR, Division of Kaman Aircraft Corporation, has available their publication, "Fast Neutron Activation for Nitrogen in Grain Products," by D. E. Wood. This report presents a description of the process including the procedure for the removal of interfering reactions and conditions for optimizing the analysis. (Kaman Nuclear, Colorao Springs, Colorado.)

PARR INSTRUMENT CO. has a new 12-page illustrated bulletin, Spec. 4500 describing their new series 4500 stirrer-type pressure reactors, with self-sealing packing gland and other technical improvements. (211 Fifty-third Street, Moline, Ill.)

ANALABS has released a new 1966 catalog on gas chromatographic supplies and accessories, listing more than 400 stationary phases, as well as types of inert supports and column materials. A new section has been added on calibration standards for pesticides, fatty acids, steroids, hormones and hydrocarbons. (P. O. Box 5215, Hamden, Conn.)

UNION CARBIDE CORPORATION, Chemicals Division, has outlined the processing of Ucane biodegradable detergent alkylates in a new 44-page brochure. Included are details of sulfonation, neutralization and drying methods. (270 Park Avenue, New York, N. Y. 10017.)

• *New Products*

PHOENIX PRECISION INSTRUMENT CORPORATION, subsidiary of CENCO INSTRUMENTS CORPORATION, Chicago, Ill., has introduced an automatic recording, bench model amino acid analyzer. It requires a modest amount of material for analysis, and features highly accurate and reproducible flow settings.

QUICKFIT REEVE ANGEL, Inc., Clifton, N. J., has announced the availability of its new 5-liter Multi-Purpose Extractor, for use in solid/liquid, liquid/liquid upward displacement, and liquid/liquid downward displacement.

DISTILLATION PRODUCTS INDUSTRIES, a division of Eastman Kodak Company, Rochester, N. Y., has a new form of Eastman Chromagram Sheet, 6062, carrying a coating of alumina adsorbent for use in thin-layer chromatography where alumina is the adsorbent of choice.

PHARMACIA FINE CHEMICALS, INC., Piscataway, N. J., has designed new Sephadex laboratory columns as a standard column for gel filtration and ion exchange chromatography with aqueous systems. The column is designed to serve as one basic column system for both descending and ascending chromatography.

CONTINENTAL OIL COMPANY, New York, has developed two new synthetic detergent-range alcohol blends, ALFOL 1218 alcohol and ALFOL 1812 alcohol. Both offer excellent processing and lower costs for compounders of detergents.

PHARMACIA FINE CHEMICALS, INC., Piscataway, N. Y., has added Sephadex LH-20 as the first lipophilic derivative to extend the use of Sephadex gel filtration technique to organic solvents.