World Conference Technical Paper Abstracts

Monday, October 2

Session I. World Fats and Oils Situation

A. World Supply & Demand of Oils and Fats

Thomas Mielke, ISTA Mielke GmbH – Oil World, P.O.B. 90 08 03, 2100 Hamburg 90, Federal Republic of Germany

The speaker will focus on the prospective development of supply, demand, prices and price relationships for the 89/90 season. What lies ahead? Latest estimates will be provided for the oilseed production in all major countries of the world. It will be discussed whether and to what extent the depleted world oilseed inventories can be replenished. The speaker will outline the latest projections of 89/90 production, imports, exports, disappearance and stocks of major oils and fats. The analysis of the strength of the world demand of oils/fats on the one hand and oilmeals on the other will provide an answer for the relative oil price strength to be expected for the new season. It will be discussed why world demand should swing back to soybean oil and meal in 89/90. An analysis will be provided for the development of 'surplus stocks' of major oils in major countries and implications for future price changes will be discussed. Finally, estimates for the major suppliers and consumers of oils and fats will be presented with special attention given to the import demand of China, India, and the U.S.S.R.

B. International Economics and Politics

Dennis B. Sharpe, Economic and Corporate Relations, American Soybean Association, P.O. Box 27300, St. Louis, MO 63141 USA

The interaction of economics and politics is discussed in the context of the world market for fats and oils. The analysis indicates the industry may be on the threshold of significant change. The engine of world economic growth is expected to shift into higher gear. Key markets are expected to show renewed vitality as resolution of the Third World debt problem moves from a restructuring strategy to a reduction strategy. Economic forces and political considerations have brought about changes in the Communist Bloc countries that may imply more margarine and less missiles. Political policies in India, Pakistan and key African countries have shifted away from state planning toward more private free enterprise resulting in higher economic growth rates. The current GATT negotiations on agricultural trade epitomizes the Yin and Yang of international politics and economics. The negotiators are torn between national self interests and the fruits of compromise. How the GATT issues are resolved will have far reaching implications with differential impacts on selected fats and oils. The interactions of economics and politics relating to biotechnology and the environment are explored. It is postulated that the growth hormone for swine (PST), if found economically and politically feasible, could have significant positive demand impact on soybeans and therefore the relative price and availability of competing fats and oils.

C. Trading Rules and Regulations

Ronald Fleming, Capital City Products, P.O. Box 569, Columbus, OH 43216 USA

abstract not available at press time

Session II. Storage, Handling and Shipping Practices

A. Marine Transportation of Edible Oils and Fats

Joseph E. Ludwiczak, Stolt-Nielsen Inc., P.O. Box 2300 Greenwich, CT 06836 USA

International transportation and cargo handling practices of edible oils and fats are presented from a viewpoint of quality assurance. Ship design, tank suitability, preparation and cleaning procedures are described. Types of ships currently utilized by the industry are compared and shipper's quality control criteria for carrier selection are discussed. Current handling practices, including loading, voyage, and discharge operations are reviewed, concluding with an evaluation of the recent transportation and handling quality improvement developments of the edible oils and fats industry.

B. Buyer/Recipient Viewpoint

Peter Backlog, Unilever Grondstoffen Maatschappij B.V., Postbus 760, 3000-DK, Rotterdam, The Netherlands

A brief review will be given of the main methods and terms used in shipping oils and fats, e.g. "CIF", "FOB", "GMQ", etc. The buyer/recipient viewpoint on the types of ship to be used, handling methods and superintending practices will be discussed. The difference between buying on simple specifications for crude oil and more detailed ones for refined oils will be illustrated and a suggested definition offered for "Adulteration" and "Contamination" with examples of both. Recent joint work in this field by N.I.O.P. and F.O.S.F.A. will be briefly reviewed. The needs of the end-user with regard to avoiding transhipment and other unnecessary pumping of oil will be mentioned.

Session III. Separation and/or Extraction of Fats and Oils

A. The Effect of Technology on the Quality of Animal Fat

Geir Søbstad, Alfa-Laval Fish and Meat Engineering A/S, Maskinvej 5, DK-2860 Søborg, Denmark

Fat in its raw form is not fit for human consumption until it is classified as edible by the veterinarian inspector and must then be handled hygienically and stored or passed on to the rendering department for processing into edible fats and cracklings. Normally the raw material must have high fat content, usually between 65 and 95%. However, it is also possible to produce edible fat from other raw

materials. The pretreatment of the raw material is very important and the type of raw material must be considered, as well as storage conditions. On the product side, the most important quality criteria for edible fat are:

- low content of free fatty acids (FFA) and water
- low peroxide value
- neutral taste, flavor and color
- good keeping qualities

Important to know is that although there are benefits from the dry-rendering method of processing as well as for the wet-rendering process, the operation of the process is an important parameter in producing a good fat quality. The relation between water content and FFA in the fat is fairly well known, but the relation between the process and the keeping qualitics as peroxide value, taste, flavor and color is less known. In a market with a surplus supply of fats and oils, the quality of the product is increasingly important as are knowledge about the quality criteria as well as ways of controlling them. The ways in which process will affect quality are discussed.

B. Separation, Deodorization, and Refining of Marine Oils

Geir Søbstad, Alfa-Laval, Fish & Meat Engineering, A/S S Maskinveg, DK-2860 Soeburg, Denmark

abstract not available at press time

C. Mechanical Pressing

Norm Buhr, CSP Foods Ltd., P.O. Box 750, Altona, Manitoba, R0G 0B0, Canada

The early development and application of mechanical extraction of vegetable oil will be discussed. The current methods of mechanical extraction including preparation and prepressing will be discussed stage by stage, highlighting the processes that are required to maximize efficiency. An additional processing step called extrusion has produced improved operational results and will be discussed as it relates to high oil content seed.

D. Solvent Extraction of Oil from Oilseeds: The Real Basics

Jose R. Lajara, Cargill España S.A., Avda. Diagonal, 605.4°, 08028 Barcelona, Spain

The efficiency of an industrial process of solvent extraction of oil involves the monitoring of the factors affecting the transfer of oil from the solid to the solvent, and the draining and wash out of the extracted material at the end of the process to reduce the residual oil in the spent solids. Factors related to the oil-bearing material, seed preparation and extraction stage are reviewed with special emphasis in flaking, moisture, percolation and temperature.

E. Separation of Fats and Oils by Solvent Extraction: Non-traditional Methods

Edmund W. Lusas and **Lawrence R. Watkins**, Food Protein Research & Development Center, Texas A&M University, FM-183, College Station, TX 77843 USA

Non-traditional practices in solvent extraction of oils include variations in seed preparation; extraction process; type of solvent used, including composition of hexane; and recovery of solvent from the miscella. This paper reviews recently-introduced commercial processes as well as reported research. Applications of expanders will be discussed, including data on soybean and cottonseed preparation and energy cost savings of up to $2-3/ton of seed processed; applications to high-oil content seeds; and reasons why some past installations have not worked. Additionally, effects of commercial hexane subcomponents on extraction; status of alternative solvents development, including alcohol, isopropyl alcohol and methylene chloride; limitations of supercritical CO_2 and aqueous processing; and progress in membrane separation of miscellas will be covered.

Tuesday, October 3

Session IV. Refining of Fats and Oils

A. Degumming – Theory and Practice

J.C. Segers and **R.L.K.M. Van de Sande**, Unimills B.V., Lindtsedijk 8, 3330 AA Zwijndrecht, The Netherlands

Degumming of vegetable oils, either crude or already water-degummed, serves several purposes. One is to remove impurities like phospholipids and carbohydrates to such a degree that the oils can be physically refined. Another purpose is to facilitate subsequent alkali refining and to reduce particularly phosphate pollution in effluent from alkali refining. The ultrafiltration process, various acid degumming processes, e.g. super-degumming, and also the alcon process are examined on their mechanism and efficiency against the background of the above mentioned purposes. Additionally the state of the art of the different degumming processes and their economical merits for different applications are discussed.

B. Neutralization I. Theory and Practice of Conventional Caustic (NaOH) Refining

Blake Hendrix, Johnson-Loft Engineers, Inc., 3100 Kerner Blvd., Suite C, San Rafael, CA 94901 USA

Conventional caustic refining (neutralization) remains the most widely practiced method of removing free fatty acids and other undesirable impurities from fats and oils. The basic chemistry and refining theory are discussed. The two major types of continuous refining processes in use today are reviewed and compared. Processing parameters and their effects on product yields and quality are presented. How state of the art control instrumentation is affecting caustic refining in the process plant is also discussed.

C. Miscella Refining as Integrated Unit Processes in Oilseed Solvent Extraction Plants

George C. Cavanagh, Cavanagh Associates, 1752 A West Calimyrna Ave., Fresno, CA 93711 USA

The basic objective of refining edible vegetable oils is to obtain the greatest possible yield of an acceptable quality

of finished product from the source material with the least possible loss of oil and tocopherols. Compared to conventional continuous caustic refining, miscella processing provides the advantages of greater throughput per centrifuge due to much lower viscosity of miscella compared to oil and more efficient separation of phases due to greater difference in specific gravity between light and heavy phases. Data on miscella degumming, dewaxing, neutralization, bleaching, hydrogenating and winterizing performed as continuous integrated unit processes at the oilseed extraction plant are discussed. Economic considerations dictate that miscella processing is most effectively and efficiently performed at the solvent extraction plant.

D. Bleaching – Theory and Practice

Theodore K. Mag, Canada Packers, Inc., Research Centre, 2211 St. Clair Avenue West, Toronto, Ontario M6N 1K4, Canada

The process of bleaching has seen considerable evolution in concept and application in recent time. Its effect on oil properties is now recognized as going much beyond color removal to other compounds deleterious to oil quality and to side reactions. The theoretical foundations of bleaching encompass adsorption on surfaces, the chemistry and catalysis of side reactions, principles of liquid-solid mixing and of air and moisture removal, and the kinetics of these processes. Modern practice has come to rely almost entirely on processes operating in the continuous mode and under vacuum. Adsorbents are primarily acid-activated clays. Recent developments in adsorbents are more active clays and synthetic silicas. Active carbon is used for very specific purposes. Process control covers the range of aspects of bleaching, especially determination of color. Long-established comparative methods as well as spectroscopic methods are in use. Modern practice also exercises analytical control over trace metals, oxidation products, phosphorus, certain nutritionally undesirable compounds present in some oils and moisture present during bleaching. Very little on-line automatic control is practiced because of difficulties in providing adequate sensing devices. Spent adsorbents are processed in a variety of ways for safe disposal.

E. Deodorization – Theory and Practice

Stanley C. Loft, Johnson-Loft Engineers, Inc., 3100 Kerner Blvd., Suite C, San Rafael, CA 94901 USA

abstract not available at press time

F. Physical Refining

F.V.K. Young, Vernon Young Consultant Ltd., 12 Woodlands Road, Formby, Liverpool L37 2JW, United Kingdom

Physical refining is a combination of the processes of degumming, adsorption, filtration and a final distillation step which incorporates deodorization. The use of the physical refining process is dependent upon the quality of the crude oil and the desired quality of the refined oil, therefore the application of quality assurance based on analytical results relevant to individual oil types is important. The pretreatment prior to distillation must be modified according to the type and quantity of contaminants present, but although the process has certain environmental advantages over chemical refining, physical refining can become uneconomic if the pretreatment costs are too high. The process has been in use for over 50 years during which time there have been big improvements in efficiency of the distillation step particularly in energy consumption, but plant design has seen modifications rather than basic changes. Process control is the facet which has given the most benefit to the user in recent years.

G. Dewaxing/Fractionation

T. Willner, W. Sitzmann, E.W. Münch, Krupp Maschinentechnik, Seevestraβe 1, 2100 Hamburg, Federal Republic of Germany

Composition of special fats through specific processing techniques like hydrogenation, transesterification and fractionation is increasingly gaining importance. In the process, desired properties of the fats to be produced are preset through their specific area of application. Special fats are used, for example, in the production of margarine, shortenings, sweets and cosmetics. The presentation will discuss the broad theme array of the production of cocoa butter replacers (CBR). CBRs are increasingly gaining interest, particularly in countries without statutory limits on the use of cocoa butter substitutes in chocolate products. Apart from that, cocoa butter replacers are widely applied in the manufacture of coatings and fillings. The objective is to substitute, wholly or in part, the relatively expensive cocoa butter for comparable fat fractions of lower priced base materials such as palm oil, palm kernel oil, etc. The applicable fractionation methods can be divided into three groups: (1) crystallization in solvents (solvent fractionation), (2) crystallization and phase separation by the use of detergents (wet fractionation), (3) crystallization of the melted material with mechanical phase separation without auxiliary agents (dry fractionation). Compared to dry fractionation, auxiliary agents are advantageous concerning crystallization kinetics, selectivity, and sometimes yield of product. On the other hand, disadvantages such as higher investment and operating costs, and particularly physiological misgivings about auxiliary agent's residues in the final product must be considered. As a consequence of the successful improvement by Krupp of the dry fractionation process for CBR production, this processing method has again become a definite point of intensified interest.

H. Cost/Quality/Health – The Three Pillars of Hydrogenation

Robert C. Hastert, Engelhard Corporation, 30100 Chagrin Blvd., Cleveland, OH 44124 USA

Cost of processed products, routine attainment of desired performance and appearance characteristics, and a positive contribution to short term nutrition and long term health are legs of the 3-legged stool of successful hydrogenation. The purchase and proper upstream preparation of suitable feedstocks are the first cost ingredients. Hydrogenating them in efficiently designed equipment using very pure hydrogen and high quality catalysts are the next important parameters. Utility and

labor costs are also important considerations as is astute formulation. Many options and variations for each of these items are available and should be considered in both long term planning and short term scheduling. Achievement of high quality is dependent on astute formulation and requires rigid adherence to hydrogenation manufacturing practices known to enhance and maintain the physical and chemical properties necessary for the finished product to have the desired performance and organoleptic characteristics. The importance of maintaining consistence and achieving ever higher quality is increasing. Hydrogenation has a direct relationship to the nutritional and health aspects of fats and oils products. While somewhat of a moving target and with conflicting opinions among the so-called experts in the field, ignoring its importance is perilous in today's marketplace.

I. Interesterification of Oils and Fats

A. Rozendaal, Unilever Research Laboratory, Oliver Van Noortlaan 120, 3133 AT Vlaardingen, The Netherlands

Interesterification is applied to modify the physico-chemical properties of oils and fats, especially their melting, crystallization and recrystallization behavior. The process is most efficiently catalyzed by basic catalysts, e.g. sodium alcoholates, and can be carried out batch wise or continuously. Control of free fatty acid and moisture content is essential. The overall kinetics is dependent on a catalyst activation step and a real ester interchange step. This will be illustrated by experimental data on simple esters and triacylglycerols. The main mechanism of interesterification of oils and fats involves a nucleophilic reaction between triacylglycerol and catalyst anion.

Session V. Nutrition in Relation to Processing

A. Trans-Unsaturated Fat in Nutrition and Health

David Kritchevsky, The Wistar Institute of Anatomy and Biology, 3601 Spruce Street, Philadelphia, PA 19104 USA

The major products of fat processing in the American diet are the trans-unsaturated fatty acids which arise during hydrogenation. Most studies suggest that trans-unsaturated fat (trans fat) is metabolized similarly to cis fat, although in some cases at a slower rate. It should be noted that one of the steps in normal physiological degradation of fatty acids involves a trans double bond. Trans fat is metabolized and turned over in a normal fashion; it does not remain in tissues as might be expected from a foreign fat. Rats or monkeys fed a diet high in trans fat accumulate it in blood and tissues but the fat disappears soon after removal of the dietary stimulus. It has been suggested that trans double bonds may confer some properties associated with saturated fatty acids but this hypothesis has not been subjected to rigorous testing. The effects of trans fat in atherosclerosis have been a subject of research for thirty years. McMillan and his colleagues found that trans fat was more cholesterolemic but not more atherogenic than cis fat. Others have confirmed this finding. Comparison of tissues from human subjects have shown no preponderance of trans fat in persons who died of coronary disease compared to those who died of other causes. Experiments using trans fat in diets of rats bearing experimentally-induced tumors have shown it to be of no greater co-carcinogenicity than cis fat. Other aspects of fat processing which merit study are effects of randomization and of the positional and configurational isomers of fatty acids which may arise during hydrogenation.

B. How Can the Processing of Fats and Oils Meet Tomorrow's Demand for Foods of Higher Nutritive Value? A European Perspective.

G. Rocquelin, Institut National de la Recherche Agronomique, 17 rue Sully, 21034 Dijon-Cédex, France

It is becoming increasingly clear that dietary lipids exert a marked influence on biological membranes, hence on cell function. In most European countries dietary fats represent 40% or more of daily energy intake. This percentage is considered to be too high by 20 to 25% in light of the potential health risk of cardiovascular disease and possibly some cancers. Although the appropriate levels are still debated, there is a consensus that cholesterol and saturated fatty acids consumption should be limited and a higher intake of polyunsaturated cis n-6 and n-3 essential fatty acids encouraged. Dietary habits continue towards greater uniformity. Consumer demand for meals away from home and convenience foods is increasing with the result that more highly processed and ready to eat foods in which processed fats (new hidden fats) share an important place will be produced. At the same time, paradoxically or not, expression of consumer concerns for "natural" and "health" foods will grow. New sources of fats and oils will be introduced on the market along with low fat products and fat substitutes. Biotechnologies to create new, nutritionally-improved fats will also be assayed. The fats industry will have to demonstrate that new processed fats or fat containing foods meet hygienic, organoleptic and nutritional requirements. More attention thus must be given:

1 – To the quality of raw materials that determines the processing conditions to be applied;

2 – To good practices of traditional fat processing to avoid or limit vitamin and essential fatty acid loss and the occurrence of nutritionally undesirable compounds (cyclic monomers, polymers, oxidized compounds, *trans* isomers);

3 – To new and less degenerative technologies;

4 – To packaging and storage conditions to avoid oxidation and contamination of ingredients; and finally

5 – To the possible interactions between fats and other ingredients of new processed foods which could lower their bio-availability. Not only the nutritional evaluation of new foods but the reinforcement of analytical and microbiological controls of food quality will be required.

Wednesday, October 4

Session VI. Formulation and Processing of Finished Products

A. Shortening Products

Fred R. Paulicka, Durkee Industrial Foods Corporation, 16651 Sprague Road, Strongsville, OH 44136 USA

The history of U.S. shortening products technology is presented. Their role as essential ingredients in finished food products is discussed. Properties of different shortening types are presented and compared. The general classification of shortening types includes plastic or semi-solid non-emulsified and emulsified, fluid and clear liquid. Recent trends in shortening technology are discussed, particularly those products developed to satisfy needs and opportunities in nutritional and microwave markets.

B. Shortening – European Perspective
Joerg Klimes, Noblee & Thorl GmbH, Seehafenstrabe 24, D-2100 Hamburg 90, Federal Republic of Germany

Basic components, formulations and finished product characteristics of typical European shortenings are presented. The survey covers various plastic shortening types as well as pourabls and dry shortenings. Technical equipment and process conditions for crystallizing and texturizing of shortenings are illustrated.

C. Formulation and Processing of Finished Products – Margarine/Spreads
Ahmad M. Moustafa, Consultant, 2476 Little Dry Run Road, Cincinnati, OH 45244 USA

In the 120 years since its invention, margarine has come of age. It is the preferred spread by the consuming public despite all the legislative attempts to restrict its growth in many parts of the world. Credit must be given to the combined efforts of oil chemists, food technologists and engineers for this phenomenal success and growth. In the USA, the industry has kept the consumer well informed about the nutritional values of margarine. Not only that, but it reformulated to meet all the newer nutritional and health demands recommended by the medical profession as evident by the polyunsaturated margarines and as of late the lower calorie spreads. Production and selling practices of margarines in the USA are explored and compared to those practiced in Europe.

D. Low Calorie Spread and Melange Production in Europe
Jórgen Madsen, Grindsted Products, Edwin Rahs Vej 38, DK-8220 Brabrand, Denmark

The literature about low-calorie spread and melange products is reviewed. Many patents have been taken out on low-fat spread with 40% fat, particularly in Great Britain, but more recent patents with even lower fat content (15-30%) have been taken out as European patents. Today melange products are mainly produced by adding soybean oil in order to soften butter, whereas previously butter was added to margarine in order to improve the taste and obtain advertising advantages. In addition, the relevant legislation is commented upon. Minarine with 40% fat is allowed in most European countries, whereas low-calorie butter was not allowed in most countries in 1988. An attempt is made to present production figures for European countries for 1988, although there is no clear distinction between minarine, low-calorie butter and melange products. Processing conditions for a Perfecter pilot plant, typical recipes for the 3 types of products, and evaluation parameters are given. At first minarine was produced with water and salt only in the water phase, due to emulsion stability and shelf-life problems. Once technological improvements had been made, it became possible to produce minarine with milk protein, and a better flavor release and taste were achieved. A high content of milk protein was also advertised as having a higher nutritional value.

E. Confectionery Fats
V.K.S. Shukla, Analytical Research & Development, Aarhus Oliefabrik A/S, DK-8100, Aarhus C, Denmark

Chocolate is associated with an imported commodity, the cocoa bean. The total fat content of the whole bean on the dry basis is around 48-49%. Cocoa butter is an important major constituent of chocolate formulations. The specific chemical properties of cocoa butter are due to its symmetrical monounsaturated triglycerides (75%) with oleic acid in 2-position. This unique triglyceride composition together with extremely low levels of diglycerides attribute to the desirable physical properties of cocoa butter and its ability to recrystallize during processing in a stable crystal modification. The continued research in the field of confection science resulted in the development of tailor-made fats resembling the physical and chemical properties of cocoa butter, the so-called cocoa butter equivalents (CBE). Various exotic tropical fats are used in manufacturing CBE's in order to match the qualities of cocoa butter. This paper highlights in detail the chemical and physical properties of cocoa butter, CBE's and cocoa butter substitutes.

Thursday, October 5

Session VII. Individual Oils: Animal, Marine, Palm

A. Animal Fat – Basic Principles of and Modern Practices in Processing
Norman J. Smallwood, The Core Team, P.O. Box 1321, Hammond, LA 70404 USA

Within the arena of ever increasing competition from vegetable sources, concern over diet by the consuming public, and environmental regulatory pressures, the processors of animal fat are challenged to maintain economic vitality by improved processing techniques. The purpose of the presentation is to outline the basic principles and latest technological innovations in animal fat processing to maximize product quality and yield and minimize processing expense and environmental impact. The subject is covered from the composition of animal fat through handling, refining and subsequent processing. For each step, the objectives, significant unit operations, equipment applications, process conditions and process control techniques are examined. Implications of both integrated and stand-alone animal fat processing operations are identified. Environmental issues related to animal fat are explored with respect to process design and operation. Finally, the advantages of and future prospects for animal fat use are discussed.

B. Fish Oils – an Old Fat Source with New Possibilities
Johannes Opstvedt, N. Urdahl and **J. Pettersen**, Norwegian Herring Oil and Meal Industry Research Institute, N-5033 Fyllingsdalen, Bergen, Norway

The production of fish oils is concentrated on a few countries in Northern Europe, North and South America, East Asia and Africa. Likewise, the main part of the consumption of fish oil occurs in a few countries in Northern Europe and South America. The geographical distribution of production and consumption and availability of fish oil in comparison to other fats and oils are described in some detail. It is shown that the composition of natural (crude) fish oil depends on species of fish and season of catching. Further, it is shown that the composition of processed, hydrogenated fish oil depends on the processing conditions and is affected by the composition of the crude oil. The traditional use of fish oil is in the hydrogenated form in margarine, shortenings, etc. It is pointed out that recent interest in providing n-3 fatty acids for human consumption has created new markets for unhydrogenated fish oil. A sketch of the traditional hydrogenating processing is shown with emphasis on some key points. Further a brief outline of processes which may be used to manufacture fish oil and fish oil fractions rich in n-3 fatty acids is given.

C. Palm Oil: Edible Oil of the Future
K.S. Law and T. Thiagarajan, PORIM UK, Brickendonbury, Hertford, Herts, England and PORIM, P.O. Box 10620, Kuala Lumpur, Malaysia

Palm oil plays a very important role in the agro-based industry of Malaysia as it accounts for 10% of foreign exchange earnings. Since the independence of the country in 1957, her palm oil sector has progressed at a semi-exponential rate. Oil production leapt from a mere 95,000 tons in 1960 to 5.0 million tons in 1988. In terms of total world palm oil production, Malaysia has a 60% share. In fact, in terms of liquid cargo volume exports, it is the largest in the world. In comparison with total world oils and fats, palm oil contributes 11% of world edible oil production and is increasing rapidly. In addition to palm oil (a mesocarp oil), palm kernel oil with a different composition is produced from the same fruit. Emphasis will be placed on the unique properties of palm oil both in terms of its compositional and nutritional attributes. The main utilization pattern of palm oil products will be discussed in relation to their techno-economic advantages in major food products. The special processing requirements of palm oil will be discussed in connection with the strict environmental measures imposed by government legislation on the industry. Potential utilization of the biomass and other by-products will also be briefly mentioned.

Session VIII. Individual Oils: Laurics, Soy, Sun, Rape

A. Laurics (Coconut, Palm Kernel)
Manfred Graalmann, Walter Rau Lebensmittelwerke GmbH & Co.KG, D-4517 Hilter 1, Federal Republic of Germany

Production of lauric oils in comparison to the world production of other edible oils and fats and the geographical distribution is shown. Development of palm kernel oil and coconut oil is influenced by competition of palm oil and the major liquid oils and with growing importance by usage in the field of oleochemicals. Aspects such as replanting, fertilizing and hybrid programs will be considered. Processing to edible products and oleochemicals, practices evaluated to overcome aflatoxin and PAH problems, and utilization of laurics as edible products and oleochemicals will be described.

B. Soybean Oil – Modern Processing and Utilization
David R. Erickson, American Soybean Association, P.O. Box 27300, St. Louis, MO 63141 USA

The history of soybean oil (SBO) is presented and compared to that of the major edible vegetable fats and oils. Soybean oil composition is compared to other oils and normal and alternate compositions are shown and considered. The relative value of the soybean meal and soybean oil components are shown and described in relation to the total market. The normal and expected variability of the composition of crude soybean oil is related to methods of extraction, soybean quality and other factors. The critical considerations in the processes of extraction, degumming, refining (chemical and physical), hydrogenation and deodorization are shown and discussed. The current consumer acceptability of refined, bleached and deodorized soybean oil is discussed, concluding with a consideration for the future production of soybean oil.

C. Sunflowerseed Oil
J. Veldstra and **J. Klere**, Astra-Calve, 14, rue Louis Armand B.P. 260, 92601 Asnieres, France

Sunflowerseed oil is one of the major vegetable oils in the world. The oil is obtained from the seeds of the plant Helianthus annuus. In this paper the world production of sunflowerseed and oil is compared to the production of other oils and fats. Moreover, the composition of the seeds and the oil, its fatty acids, tocopherols, sterols and phospholipids are given. Attention is given to the influence of climate on the fatty acid composition and the appearance of high oleic acid cultivars. Discussed are the processing of the seeds and the oil. Sunflowerseed oil is characterized by a high content of linoleic acid, an essential fatty acid and alpha-tocopherol, vitamin E. The oil is widely used for human consumption. Examples are oil, cold use or for frying, and spreads. The meal of the seeds is used for animal nutrition.

D. Canola (Low Erucic Acid Rapeseed)
Roy A. Carr, POS Pilot Plant Corporation, 118 Veterinary Road, Saskatoon, Saskatchewan S7N 2R4, Canada

The Oilseeds, Fats and Oils Industry in Canada is primarily the story of canola. More than half of all edible oils used in this country are from the canola oilseed. Over 70% of all salad oils in Canada are made from canola because of its distinctive composition. Because canola (lowerucic acid varieties of rapeseed), has recently been included on the GRAS list, there is a growing interest by end-users and processors outside of Canada in its distinctive fatty acid composition. The first Canadian low-erucic variety of rapeseed, called ORO, was released in 1968. By 1973, Canadian conversion from high-erucic rapeseed to low-erucic canola varieties was virtually complete. In effect, a new vegetable oil had been developed by man to compete with the traditionally available vegetable oils. Canola is now grown extensively in Canada, primarily for the oil content which is ca. 40% of the seed. The remainder of the seed produces a high protein meal product, extensively used for livestock feed. The objective is to provide a brief history of canola development and a summary of the processing unit operations for canola from seed to finished products. In addition, chemical, physical, sensory and nutritional properties of canola will be described.

Session IX. Individual Oils: Cotton, Peanut, Corn, Safflower, Rice Bran and Olive

A. Understanding Cottonseed Oil

Lynn A. Jones, National Cottonseed Products Association, P.O. Box 12023, Memphis, TN 38182-0023 USA

Cottonseed oil was one of the first vegetable oils to be commercially processed and many of the technical developments of the modern vegetable oil industry were perfected using cottonseed oil. The oil currently accounts for about 4% of the vegetable oil used in the U.S. and 6-7% of the vegetable oil produced in the world. In 1987-88 world consumption of cottonseed oil was 3.34 million metric tons. China, the Soviet Union, U.S.A., Pakistan, India and Brazil together produce about 75% of the world's cottonseed oil and are ranked in that order. Since cottonseed oil is a co-product of cotton fiber production, its availability is dependent on the relative fortunes of cotton textiles. Cottonseed processing is unique due to the presence on the raw seeds of cotton linters which must be removed before the seed can be hulled and extracted. Cottonseed oil contains 20-25% of high melting point stearine fractions. The characteristics of cottonseed oil include an ability to form the beta-prime crystal structure, stability, a pleasing flavor profile, and the desired functionality for many food products. The positive aspects of the oil have served as a basis for a limited domestic promotion and information effort to place cottonseed oil in a niche of its own in both national and international markets.

B. Peanut Oil: Chemistry and Properties

Robert L. Ory and **George J. Flick, Jr.**, Virginia Polytechnic Institute & State University, Department of Food Science & Technology, Blacksburg, VA 24061 USA

Though peanut oil is a major edible oil in China, India, some African and Asian countries, it is not as widely used in the United States because less seeds are crushed for oil and meal. Most peanuts are consumed as whole seed products. At almost 2 million tons per year, the United States crop is only 9-10% of the world crop. Peanut oil has excellent properties for food uses: high smoke point, good heat transfer, good oleic/linoleic acid ratio, no linolenic acid (which precludes the need for partial hydrogenation to increase oxidative stability), and imparts desirable flavor to fried foods. Refined peanut oil is non-allergenic and will not contain aflatoxins, which are not oil-soluble. The high oleic acid content (monounsaturated fatty acid) has been reported to be beneficial in prevention of the risk of heart disease. A discussion of the chemical composition of peanut oil as it relates to human health and properties that make it desirable for cooking purposes will be presented.

C. Corn Oil Composition, Processing and Utilization

Leopold R. Strecker, A. Maza and **G.F. Winnie**, Best Foods Research and Engineering Center, 1120 Commerce Avenue, Union, NJ 07083 USA

Corn oil represents only about 4% of the corn kernel and is accumulated in the embryo commonly referred to as corn germ. Differences in the composition of oil produced from corn grown in the U.S. corn belt and other countries are discussed. Reduced linoleic and increased oleic and palmitic fatty acid levels are evident in corn cultivated outside the U.S. corn belt. Corn oil recovery and refining techniques are reviewed. Refining material balance is presented as a function of crude oil quality expressed by FFA, insolubles content and an Oxidation Index (OX-IND = 1/3PV + AV). The OX-IND emphasizes the role of the secondary oxidation products as precursors of oxidative reactions detrimental to oil stability. The importance of proper processing techniques in preserving the quality of corn oil and in the removal of undesirable compounds, e.g., pesticides, mycotoxins and oxidation products, is illustrated by experimental data. Typical utilization patterns of corn oil for salads, salad dressings, frying, margarine and shortenings are highlighted.

D. Safflower

Joseph R. Smith, Oilseeds International Ltd., 855 Sansome Street, Suite 100, San Francisco, CA 94111 USA

Safflower is an ancient crop which has been produced in small quantities throughout recorded history. A survey of safflower production in various parts of the world will be presented together with a review of safflower development as a commercial crop in the last forty years. Changes in the composition of safflower seed through plant breeding and mutation will be discussed together with a review of changes in markets that have affected the value and quantities of safflower and oleic safflower oils in the United States and abroad. The development and reasons for present day processing techniques will be presented, together with a discussion of some by-products of safflower production and a forecast of possible future development.

E. Rice Bran – A New Source for Edible and Industrial Oil

M.M. Chakrabarty, Centre of Advanced Studies on Natural Products, Department of Pure Chemistry, Calcutta University, 92, Acharya Prafulla Chandra Road, Calcutta 700 009, India

Rice bran, a by-product of the rice milling industry, offers an additional oil source to the total availability of edible oils and other valuable by-products for human use. The major quantity of rice is produced in the nine countries in South Asia, although there is also considerable rice production in the USA, Europe and in part of Latin America. The largest rice producing country is China, followed by India and other Asian countries. Recent findings, including the fact that rice bran oil lowers serum cholesterol, have brought about immense possibilities for rice bran, particularly in health aspects. In the year 2,000 the share of rice bran oil may be at least 5%, and the total production of about 400 million tons of paddy may yield about 5 million tons of the oil of edible grade. Paddy can be processed by modern techniques for recovery of better quality oil and by-products, although old technologies are still being followed in India, China and other Asian countries. The oil content of rice bran varies according to the process of milling, varieties of rice, method of stabilization, and a number of other factors. The quality of oil is influenced by the presence of active lipase present in the rice bran which hydrolyzes the triglycerides to fatty acids. The delay in the extraction of the bran without prior stabilization may generate up to 20-60% fatty acids and dark color in the oil. The variation in the composition of fatty acids and triglycerides and minor lipids, e.g. phospholipids, glycolipids, etc. and also non-glyceride components, e.g., waxes, sterols, oryzanols (ferulic acid esters), tocopherols and hydrocarbon besides pigments and odor components have been reported. Recently new processes for stabilization of rice bran, deacidification, modification for better utilization of rice bran as a dietary supplement as also for bakery and health foods have been developed. An overview of the possibilities of the rice bran both as food and as source of oil for edible and industrial utilizations will be given.

F. Technological Evolution in the Different Process of Olive Oil Extraction

Jose Alba Mendoza, Instituto de la Grasa y sus Derivados, Apartado 1078, 41012 Sevilla, Spain

Due to today's quality criteria about virgin olive oil as it was stated by the International Olive Oil Council and the European Community, the oil branch, in general, has considered it necessary to improve the global quality of the oil to fill the demand of its consumers. The essay analyzes all the different technological processes that are being adopted in the extraction systems by pressure and centrifugation in Spain and the main producer countries. It describes, too, the equipment used in the preliminary phases and the economical valuation of the fruit in the cooperatives. The equipment used in the preparation of the paste, the partial extraction and the separation solid-liquid and liquid-liquid. The presentation also comments on the use of technological coadyuvants such as the results obtained from industrial testing with these products. Similarly it examines the use of the extraction system by centrifugation and the tendency to sue decanters of large capacity. Finally, the work presents the results of a comparative study done in cooperatives where the two systems of extraction are used.

Friday, October 6

Session X. Quality Control/Analytical

A. Quality Control in Edible Oil Processing or Controlling Quality in an Edible Refinery

John Podmore, Central Edible Oils, R&D Center, P.O.B. 27, Tunningsbridge Road, Pootle, Liverpool L30 6XR, United Kingdom

The paper will define quality and quality control in order to identify where responsibility lies for these functions. The objectives of process qualtiy control will be discussed. The way in which quality control procedures interact with process control and how the interpretation of the test relies on the application of defined treatments. The importance of maintaining the shortest possible information loop in order to maximize control will be noted. The basic process quality control scheme for a refinery handling a range of oils from fish oil through animal fats to vegetable oils will be outlined. The analyses carried out as athe various key points and their frequency in the processes will be identified. The test methods selected and their accuracy will be considered. The process quality control steps demanded to ensure good quality for physically refined oils will be discussed. Quality control in the hydrogenation process will be discussed both from the quality of feedstock to ensure high efficiency and control of the process to minimize variation in the hardstock. Finally the discussion will be summarized with additional comments about the application of newer rapid methods of analysis and in line testing to minimize the information loop.

B. Finished Product Quality Assurance

P.Y. Vigneron and **R. Georgin**, Lesieur Alimentaire, B.P. 89, 59412 Coudekerque-Branche Cédex, France

Processors of edible oil must be sure that, before delivery, the finished products comply with the customer's expectations and with the regulations. The consumer does not always clearly state the specifications he expects but, according to marketing studies, he seems to pay attention to appearance, taste, harmlessness of the product, shelf life and cooking performance and information on the label. Although most of these requirements have already been examined during the process quality control, it is advisable to check these specifications again to be sure that storage for an indefinite time has not had a detrimental effect on the quality. Some other requirements imply much more sophisticated analyses which can only be performed by a centralized laboratory. These include, in particular, assurance of the absence of contaminants and the control of the purity of the oil. Required analyses on each of these topics are briefly described. It is also important to monitor a general survey of the quality of the product in stores through regular sampling of both proprietary and competitive products. Quality insurance organization demands that the company provide a consumer service devoted to answering any written or phoned questions, especially in regard to complaints.

C. Research Methods/Automated Analytical Methods

Mark G. Matlock, Archer Daniels Midland Company, P.O. Box 1470, Decatur, IL 62525 USA

Modern analytical laboratories whether primarily performing quality assurance or research and development rely heavily on computers to perform many tasks. For this reason computer literacy and experience is becoming of greater importance for laboratory personnel. Many laboratory instruments today utilize a personal computer to handle the required calculations. Integrating these types of systems into Laboratory Information Systems offers additional challenges over conventional instruments. Examples of interfacing lab instruments such as Atomic Absorption spectrophotometers, and Gas or Liquid Chromatographs will be presented. Also the design of new instruments incorporating a personal computer such as an Oil Stability Instrument will be discussed. Finally, currently available statistical and graphic software packages for personal computers will be discussed with respect to their role in aiding research and development projects.

Session XI. Meal and By-Products (Processing, Use, Disposal)

A. World Production, Storage and Utilization of Various Defatted Animal and Vegetable Mid-High Protein Meals

Ronald H. Kohlmeier, American Soybean Association, P.O. Box 27300, St. Louis, MO 63141-1700 USA

The world's production of thirteen animal and vegetable protein meals over the last five years is shown. Significant nutritional parameters of each of the meals for use in ration formulation are listed. Suggested maximum quantities of each meal in swine, poultry and ruminant rations as well as general concerns and positives of each meal are presented.

B. Sources, Processing Methods and Commercial Uses of Lecithin

Greg Dashiell, Central Soya Company, Inc., P.O. Box 1400, Ft. Wayne, IN 46801 USA

Lecithin is a generic term for a complex mixture of phospholipids and other polar lipids derived from various animal and vegetable sources. The most important commercial sources are soy and egg. Other vegetable sources furnish lower quality lecithins for less demanding applications. The comparative composition of representative sources is discussed. The surfactant properties of lecithin are largely dependent upon the chemical composition. The chemical composition can be altered by a variety of procedures. The way the source materials are handled prior to extraction, the method of extraction, and the method of lecithin isolation from crude oil can affect lecithin composition. In addition, there are a number of fractionation and modification procedures of the isolated lecithin matrix which are used to create products with a wide range of hydrophobic and hydrophilic character. The many methods used to affect lecithin composition are discussed in the context of the resulting enhancement in functionality. The breadth of lecithin application is enormous. Lecithins traditionally enjoy a prominent place in the food industry as natural emulsifiers, dispersing agents, and blending agents. More significantly, lecithins or lecithin derivatives now find their way into diverse applications in agriculture (animal feed emulsifiers, nutrient source) industrial applications (mold release, pigment dispersion) and pharmaceuticals (adjuvant, suspending agent). Specific applications and the proposed modes of action are detailed.

C. Deodorizer Distillate

Robert L. Winters, Consultant, Fine Chemical Division, Henkel Corporation, LaGrange, IL USA (mailing address: Henkel Corporation, 5031 Clear Spring Drive, Minnetonka, MN 55345 USA)

The types of deodorizer distillate are presented and related to the major factors that influence them. The oil types, equipment design and operating conditions are related to distillate characteristics. The composition of distillate from various sources is shown. Collection, storage and handling are discussed with reference to yield, quality and value of the distillate. The price history and basis is shown. The current market and uses are discussed with consideration of future potential and problems.

D. Fatty Acids, Utilization and Disposal

Norman O.V. Sonntag, Consultant, 306 Shadow Wood Trail, Ovilla, TX 75154 USA

Oleochemical Utilization of upgraded quality fatty acids from vegetable oil soapstocks in the United States should increase steadily to 1995 at the expense of uncertainly priced soapstocks for feed usage. There is estimated to be a 3% annual volume increase for pet food fortification, and roughly, a 4-5% annual volume increase each for lower grade oleochemicals and low-grade cleaning, soap and other surfactant products. The utilization of soapstock for higher grade and premium quality oleochemicals depends upon the efficiency and economics of up-grading technology. New developments in methyl ester technology, absorption, oxidative and reductive bleaching and distillation, together with the treatment of soapstocks on a larger scale, for example, by accumulation from several refineries, and common up-grading, may collectively prove to be very useful. Physical refining of vegetable oils as a potential alternate to vegetable oil chemical refining, however, may be subject to limitations of by-product fatty acid quality.

Session XII. Waste Treatment/Environmental Changes

A. Environmental Trends in Fats and Oils Processing in North America

Michael J. Boyer and **Giles Farmer**, Applied Engineering and Science, 5404 Peachtree Road, Chamblee, GA 30341 USA

To understand the future of environmental trends in North America it should be recognized that historical recognition of both environmental sensitivities and correlation with process loss levels have developed slowly. However, in recent years environmental concerns have been elevated

to a major issue in the public view and industrial priorities. Increased costs of pollution control along with costs of raw materials and value of finished product has made the overall economics of pollution prevention a major issue.

B. European Perspectives

T. Donnelly, Unilever Research, Portsunlight Laboratory, Quarry Road East, Bebington, Wirral, Merseyside L63 3JW, United Kingdom

abstract not available at press time

POSTERS

P-1 New Analytical Possibilities for Quality Evaluation of Refined Oils

M.C. Dobraganes*, **M.C. Perez-Camino, G. Marquez** and **M.V. Ruiz**, Instituto de la Grasa y sus Derivados, C.S.I.C., 4 Avenida Padre Garcia Tejero, Apt. 1078, 41012 Sevilla, Spain

Quality assessment of refined oils has been based on analytical indices which may be used to evaluate efficacy of the refining process. However, these indices provide little information about later behavior of refined oils. Quantitation of non-volatile minor glyceridic components, such as oxidized di- and triacyl-glycerols, was conducted on oils before and after refining. In addition, dimeric compounds formed during refining were determined. Methods for isolation and analysis of these compounds using a combination of adsorption and high performance gel exclusion chromatography will be described.

P-2 Advances in Filtration Technology During Processing of Edible Vegetable Oils

F.G. Veldkamp, Liquid Filtration Consultants Lochem B.V., Havenstraat 5, 7240 AA, P.O. Box 35, 7241 CZ Lochem, Holland

Filter screens play an important role in the processing of edible vegetable oils. PZ80S filter screens are recommended for removal of bleaching clays; after steam treatment, the oil content of the cake will be as low as 22%. This filter also removes nickel catalysts for recycling. Totally enclosed stainless steel systems for catalyst filtration improves product quality and lowers down-time for repair or cleaning. This is of importance to modern hydrogenation plants because of limited handling of the catalyst. Other applications of filtration technology will be discussed.

P-3 Acid Water Resource Recovery, an Environmental Treatment Alternative

R.S. Daniels, Daniels Fertilizer Co., 80 Old Faith Road, Shrewsbury, MA 01545 USA

The trend of environmental legislation is causing the disposition of acid water waste to become increasingly more difficult and costly. The Daniels Process, by converting this waste product into commercially viable fertilizer by-products, eliminates environmental compliance concerns while creating a low cost product of use. A zero discharge system, this process allows the refining of vegetable oils to become a closed loop agricultural process system.

P-4 Preparation of PUFA Vanaspati, Shortenings and Other Plastic Fats by Lipase Catalyzed Interesterification of Oils and Fats

M.M. Chakrabarty*, **S. Khatoon**, and **S. Chakrabarty**, Department of Chemistry, University College of Science, 92, Acharya Prafulla Chandra Road, Calcutta 700 009, India

Specific microbial lipases have been used to produce specialty fats for baking and confectionery foods that are unattainable by chemical interesterification methods. Procedures for the formation of Vanaspati enriched in *trans*-free polyunsaturated fatty acids will be discussed. The method involves blending of oils such as sal, soybean, rice bran, palmstearin, palm oil; and interesterification with microbial lipases obtained from *Mucor meihei*, *Aspergillus niger*, *Candida cylindraceae*, *Geotrichum candidum*, and *Rhizopus delemar*. Production costs for *trans*-free Vanaspati, bakery shortenings, and other fats will be presented.

P-5 Determination of Protein Content and Quality of Defatted Meal from High-Protein Soybeans

P. Kwanyuen, J.W. Burton and **R.F. Wilson***, United States Department of Agriculture, Agricultural Research Service, P.O. Box 7620, Raleigh, NC 27695 USA

A bushel of soybeans containing 41.5% protein on a dry weight basis typically yields 49 lbs. of defatted meal with 44% protein. Soybean germplasm (NC-106 and NC-111) containing 48.0 to 49.9% protein has been developed. Theoretically, these lines should produce about 50 lbs. of defatted meal having 51% protein. Laboratory scale determination of the protein and residual oil content of defatted high-protein meal was conducted to test that hypothesis. Phospholipid levels in the resultant meal were low compared to commercial varieties. Potential differences in the flavor quality of the meal were determined by GC analysis of volatile oxidation products. The amino acid composition of the meal was measured to estimate effects on nutritional quality.

P-6 Analysis of Oil Quality in Low-Linolenic Acid Soybean Germplasm

R.F. Wilson*, **J.W. Burton** and **P. Kwanyuen**, United States Department of Agriculture, Agricultural Research Service, P.O. Box 7620, Raleigh, NC 27695 USA

Experiments were conducted to test the hypothesis that the trait for low-linolenic acid concentration in the soybean germplasm line N85-2176 was determined genetically by two independently segregating alleles encoding enzymes regulating 18:1- and 18:2-desaturation. Chi-square analysis of phenotypic frequencies among F_4 progeny of reciprocal crosses between N85-2176 and N83-375 confirmed the hypothesis. Germplasm lines representative of the four proposed homozygous genotypes generated by that cross ranged from 3.4 to 9.5% 18:3. GC analysis of the volatile oxidation products formed in the oil from each genotype was used to evaluate the impact of altered 18:3 concentration on oil quality.

P-7 Quality of RBD Soy Oil in Europe

R. Leysen, American Soybean Association, Centre International Rogier, P.O. Box 521, 1210 Brussels, Belgium

The American Soybean Association has developed in Europe a quality guarantee symbol, the SOYASIGN. Oil which corresponds to the NSPA quality specifications for fully refined soybean oil can be sold under this quality label. The scheme is controlled through purchasing soy oil from the market place. Independent laboratories analyze the oils for different characteristics. The analytical results cover a period of over three years. The observed figures are reported and discussed in the light of generally accepted practices in the fats and oils industry.

P-8 Preparative Separation of Polyunsaturated Fatty Acids by Centrifugal Partition Chromatography

W. Murayama*, Y. Kosuge, Y. Nunogaki and **K. Nunogaki**, Sanki Engineering Limited, Development Laboratories, 2-16-10 Imazato, Nagaokakyo, Kyoto 617, Japan

A novel separation method, Centrifugal Partition Chromatography (CPC), has been developed for production of highly purified lipid containing PUFA. CPC uses no solid stationary support. Two phase solvent systems employing n-hexane/acetonitrile or methanol/water are used. Less saturated PUFA esters may be eluted with the less polar mobile phase by upper ascending elution, while high MW PUFA esters are obtained from the more polar phase by lower descending elution. This method yields large scale separation of highly pure n-3 and n-6 series PUFA esters from cereal oils, fish oil, and microbial lipids. Pilot plant construction and feasibility studies will be presented and discussed.

P-9 Olein Production from Animal Fats for Accelerated Oxidation Tests

H.J. Wille*, J. Loliger and **P. Gonus**, Nestle Co., Research Centre, Avenue Nestle 55, CH-1800, Vevey, Switzerland

It is desirable to test the efficacy and mechanism of antioxidants in natural fats free of synergists that may increase the induction period in accelerated stability tests. Suitable fats include meat fats from land animals containing less than 1 ppm alpha-tocopherol. Proposed analytical procedures require oils that are liquid at 25°C. Chicken fat was selected as the most suitable raw material for antioxidant tests and ESR spectroscopic studies. Results indicated that the liquid fraction of chicken fat gave increased autoxidation reaction rates due to a higher degree of unsaturation. Olein from chicken fat also was found to have interesting qualities for cosmetic applications.

P-10 Investigations on the Use of Pinch Technology on Palm Oil and Oleochemicals Processes: Factors Influencing Effectiveness and Accuracy

M.K.A. Aziz*, A. Morad and **M. Sulong**, Department of Chemical Engineering, Universiti Teknologi Malaysia, Jalan Gurney 54100, Kuala Lumpur, Malaysia

Steam, the major source of energy for Malaysian oleochemical and palm oil plants, accounts for 30% of total operation costs. The use of steam for sterilization, refining, splitting, and esterification will limit future expansion, efficiencies, and capacities of this industry in Malaysia. Palm oil refineries operate a semi-batch process where energy supply and demand units are not synchronized. Oleochemical plants are nearly continuous and require integration of these units. The Pinch technology may be adapted to analyze these complex energy integration problems, and improve energy conservation, process integration and control in these various types of plants. The use of Process Flowsheet Simulators for implementation of Pinch technology will be discussed.

P-11 Process Flowsheets for Crude Palm Oil Refining Using Simultaneous Modular Linear Matrix Equations and Microcomputer Software

M.K.A. Aziz*, N.A. Morad and **M. Sulong**, Department of Chemical Engineering, Universiti Teknologi Malaysia, Jalan Gurney 54100, Kuala Lumpur, Malaysia

Malaysian palm oil plants have operated for over 10 years without process flowsheet simulation. However, this technology has been developed for complete unit operations, including modules for properties estimation, distillation and heat exchange. Modules were linked by simultaneous linear matrix equations to simulate current and future design and operating strategies. Tests were based on a five plate column with steam injection at all stages. Various operating conditions were simulated, including vacuum and steam pressures, feed composition variation, and interaction with heat exchangers. The effect of pre-strippers, interstage heat exchangers, side-streams on the material, heat balances, and costs were examined to increase refining efficiency.

P-12 Process Simulation of Crude Palm Oil Refining Using Rigorous Mathematical Models and Comparison with Existing Techniques

M.K.A. Aziz*, N.A. Morad and **M. Sulong**, Department of Chemical Engineering, Universiti Teknologi Malaysia, Jalan Gurney 54100, Kuala Lumpur, Malaysia

Removal of free fatty acid is an extremely important step in the refining of crude palm oil in Malaysia. Advanced computer applications have been developed to model the vacuum steam stripping process and evaluate current distillation design techniques. The Lewis-Matheson, Thiele-Geddes, and Tridiagonal matrix methods were used. Results from the Tridiagonal matrix model compared most favorably with Pseudo-Binary distillation and existing design techniques. Furthermore, the model quantified the effect of minor fractions on the Vapor-Liquid Equilibrium correlations, operating temperatures, and vacuum pressures. The impact of such information on present refining theories will be discussed.

P-13 Palm Kernel Oil Leaching

N.A.H. Morad, M.K.A. Aziz*, M. Sulong, A.S. Sabri and **B.B. Ismail**, Department of Chemical Engineering, Universiti Teknologi Malaysia, Jalan Gurney 54100 Kuala Lumpur, Malaysia

Efficiencies of various methods of extraction were determined. The fundamental aspects of extraction processes were explored in an attempt to evaluate and determine improved techniques of data analysis. Experimental findings have been correlated with bench and pilot scale extractors. Results will be discussed.

P-14 Developments in the Malaysian Palm Oil Refining Industry

T. Thiagarajan, Palm Oil Research Institute of Malaysia, P.O. Box 10620, 50720 Kuala Lumpur, Malaysia

Malaysia has one of the largest edible oil refining capacities in the world. Annual total capacity of the 55 refineries is ca. 9.8 million tonnes. The advent of physical refining as a successful alternative to alkali refining for crude palm oil has resulted in the establishment of high capacity and efficient refineries. In the deodorization process, steam consumption has been reduced by using thin film technology. In palm oil fractionation, higher olein yields are obtained by use of membrane filters. Crystallization is now carried out in compact continuous plants instead of by the traditional batch method. Consistent high refined oil quality and stability are achieved by improved process control practices. PORIM also conducts an annual independent technical audit and issues certificates to competent refiners.

P-15 Use of Spices as Antioxidants for Edible Oils Processed in Iraq

T.M. Pyriadi*, N.Y. Nazhat and **A.M. Alazawi**, Department of Chemistry, University of Baghdad, Baghdad, Iraq

Use of 10 popular spices as antioxidants for "Girl Oil" were investigated. Girl Oil is the most widely consumed brand of edible oil processed in Iraq. The spices studied include dried pepper mint, cumine, black pepper, curcuma, thyme, clove seed, cinnamon, juniper nuts, coriander seed, and myristica. Peroxide contents of oil containing 0.01% (w/w) spice were determined after weeks of incubation at 45-55°C under open laboratory atmosphere. Results indicated that curcuma and juniper performed best, while black pepper gave the lowest response. Proposed mechanisms of stabilization of the oil by these spices will be discussed.

P-16 Nutritional Quality of Vanaspati-Like Fats Prepared from Blends of Palmstearin and Vegetable Oils

D.K. Bhattacharyya* and **S. Ray**, Oil Technology Division, Chemical Technology Department, Calcutta University, 92, Acharya Prafulla Chandra Road, Calcutta 700-009, India

Palmstearin, a high melting fraction of palm oil, has enormous scope of utilization in making edible plastic fats when suitably modified. A comparative study was conducted to evaluate nutritional quality of hydrogenated Vanaspati and trans-acid-free PUFA rich vanaspati-like fat products prepared from palmstearin blended with soybean, rapeseed, and sunflower oils. Coefficients of digestibility, growth response, and lipid profiles of rat tissues were determined for each type of dietary fat. Aspects of the study will be discussed in detail.

P-17 Extraction of Carotenoids from Palm Oil

Y.M. Choo*, S.C. Yap, A.S.H. Ong, S.H. Goh and **C.K. Ooi**, Palm Oil Research Institute of Malaysia and University of Malaysia, Kuala Lumpur, Malaysia

Palm oil is rich in carotenoids, containing 300-times more retinol equivalents than tomatoes. Of the 11 types of carotenoids reported in palm oil, 90% of the total is attributed to alpha- and beta- carotenes. Four methods for preparing carotene concentrates to be discussed include fractionation into olein with 10% more carotenoids and stearin, concentration via methyl esters, isolation by adsorption chromatography, and enrichment via second pressing during milling. Extraction from waste fibers and the preparation of these concentrates in the form of capsules, powders and emulsions will also be discussed. In addition, a HPLC method has been developed for quantitative analysis of concentrates.

P-18 Fractionation of High-FFA Ricebran Oils

L. Guha, R.P. Singh* and **P.N. Maheshwari**, Oil Technology Department, Harcourt Butler Technological Institute, Kanpur 208002, India

Ricebran oils of AV 32.4 (RBO-I), 65.2 (RBO-II), and 91.9 (RBO- III) were fractionated with aqueous ethanol and isopropanol at 30-60°C in miscella, raw, and degummed stages to recover oily fractions suitable for refining and making Vanaspati. Considering the yield and quality of recovered oils, the process was most effective with ethanol in degummed ricebran oils. These oils, dispersed in 95% (v/v) ethanol at 40° C for 30 min, required oil to alcohol proportions of 1:3, 1:7, and 1:10 for RBO-I, RBO-II, and RBO-III respectively for effective fractionation with acceptable yields and high quality.

P-19 The Total Degumming Process

A.J. Dijkstra* and **M. Van Opstal**, N.V. Vandemoortele Coordination Center, Research & Development Department, P.O. Box 40, B-8700 Izegem, Belgium

A novel process for degumming both raw and water-degummed oils is described. The products contain less than 0.2 ppm FE and 5 ppm P; and can be physically refined using the same level of bleaching earth as used for alkali refined oils prior to deodorization. The oil may be alkali refined with reduced loss to yield soapstock that only requires slight acidification for fatty acid recovery, avoiding the strongly polluting soap splitting process. The total process involves dispersing a non-toxic acid into the oil, mixing with a base to a degree that avoids foaming, and two centrifugal separation steps, washing, and drying or in-line alkali refining. Overall yield gain of 0.5% is expected over classical methods.

P-20 Removal of Poly Aromatics from Edible Oils

D. Shaw, Laporte Industries Limited, P.O. Box 2, Moorfield Road, Widnes, Cheshire, WA8 0JU, United Kingdom

Guidelines are proposed for removal of medium and high molecular weight and other poly aromatic hydrocarbons to acceptable levels in edible oils. Because of low volatility, these compounds are not removed during steam deodorization. Removal by adsorption with activated carbon is costly and results in high oil loss. A range of alternative adsorbents have been examined to overcome handling problems associated with activated carbon. Adsorbent materials with handling performance similar to bleaching earths are desired. A range of inorganic based adsorbents with these characteristics have been developed and will be discussed.

P-21 Investigations into the Removal of Chlorophyll and Related Pigments from Edible Oils

M.E. Davies, P.R. Shanks and **R.S. Taylor***, Laporte Industries Limited, P.O Box 2, Moorfield Road, Widnes, Cheshire, WA8 0JU, United Kingdom

Removal of chlorophyll and derived pheophytin pigments from soft oils such as rapeseed and soybean is often an important problem for edible oil refiners. Studies were conducted to determine the mechanism of adsorption of chlorophylls onto acid activated bleaching earths and related materials. UV-visible spectrophotometric and HPLC methods were developed to examine the removal of chlorophylls from pure organic solvents. This information gave a better understanding of the nature of pigment removal from edible oil systems and effects of chlorophyll removal on oil stability. Results have been used in the development of improved adsorbents.

P-22 Oxidative Stability of Instant Noodles Fried in Sesame/Vegetable Oil Blends

Gow-Chin Yen* and **Shyi-Hwai Lai**, Department of Food Science, National Chung Hsing University, 250 Kuokuang Road, Taichung, Taiwan, Republic of China

Instant noodles were fried in seven different oils, including soybean, ricebran, unroasted sesame, unroasted sesame/soybean blend (1:4 w/w), unroasted sesame/ricebran blend (1:4 w/w), lard, and soybean with 200 ppm TBHQ. Flavor quality of the noodles after frying at 180°C for various intervals from 1 to 48 hrs and a two month storage at 37®C was evaluated by chemical and sensory methods. Sensory evaluation detected negligible rancid flavor after 1-hr frying time in all treatments. After 8-hr frying time, only the samples prepared with unroasted sesame or the unroasted sesame/ricebran oil blend had negligible rancid flavor. Oil extracted from noodles in those treatments exhibited better stability than in other treatments as determined by peroxide value, dielectric constant, and total volatile material content.

P-23 A New Approach to Utilize Soybean

S. Adhikari*, A Sinha, S. Pandey and **M.M. Chakrabarty**, Ganesh Scientific Research Foundation, 64-65, Najafgarh Road, New Delhi-15, India

Pulses are important food items for all sections of humanity over the world. Development of a nutritious and economic "dhal" analogue from soya flour was considered to be a very effective way to introduce the excellent quality of soybean protein into common diets. The present study envisages development of dhal products from suitable formulations of defatted soy-flours, starchy materials and pulse-flours. Preliminary evidence indicates satisfactory results in terms of analytical characteristics, shelf life, consumer acceptance and cooking performance parallel to common dhals like bengal gram, red gram, black gram, and lentil.

P-24 Methods for Detection and Estimation of Admixed Vegetable Oils

S. Adhikari* and **J. Adhikari**, Ganesh Scientific Research Foundation, 64-65, Najafgarh Road, New Delhi-15, India

Three analytical methods for the detection or estimation of vegetable oils in admixture are presented. The first method is for the detection of palmolein adulteration in groundnut oil using silver-nitrate thin-layer chromatography. The second method describes detection of ambadi oil (Hibiscus cannibinus) in other vegetable oils by means of spectrophotometry. The third method is another spectrophotometric procedure for estimating mustard oil in ricebran-mustard blends. All methods are sensitive, selective, quick and suitable for routine application.

P-25 Membrane Processing of Crude Vegetable Oils

S.S. Koseoglu, Food Protein R&D Center, Texas Engineering Experiment Station, Texas A&M University System, FMB-183, College Station, TX 77843-2476 USA

Membrane techniques are becoming viable industrial processes for solvent recovery from oil-hexane miscellas, degumming, refining and bleaching of oils or fats. Non-cellulosic reverse osmosis and ultrafiltration membranes were used to separate hexane, ethanol, and isopropanol from cottonseed oil. These solvents were removed selectively and reused without further treatment. Crude cottonseed oil was refined with a pilot-plant scale membrane processing system using various types of membranes and operating conditions. Color, neutral oil, phospholipid, free fatty acid, chlorophyll, beta-carotene, and gossypol content of permeate and retantate fractions will be discussed.

P-26 Projected World Oilseed Crushing Capacity/Demand to the Year 2000

J.M. Stanton, Experience Inc., 1200 Second Avenue South, Minneapolis, MN 55403 USA

If population and per capita disappearance of vegetable oils continue to increase at the current rate, world disappearance of vegetable oils will grow from 55 million metric tons in 1987 to 95 million metric tons by the year 2000. This would require construction of new processing capacity of between 100 million and 225 million metric tons of oilseed, depending on type of seed. This presentation

demonstrates the current world demand by geographical area and the current oilseed processing capacity in each area. The projected demand in the year 2000 will be shown with the added capacity necessary in each location. Total demand by continent will also be presented.

P-27 Palm Olein Based Cocoa Butter Equivalent
A.R. Md. Ali* and **M.S. Embong**, Department of Food Science & Nutrition, National University of Malaysia, 43600, Bangi, Malaysia and **B.K. Tan**, Palm Oil Research Institute of Malaysia, P.O. Box 10620, 50720 Kuala Lumpur, Malaysia

Palm olein and sal fat blended in 1:1 or 7:3 (w/w) ratios were co-fractionated under various procedures to produce a cocoa butter equivalent. Fractionations were performed at 3, 10, and 15°C with oil:solvent ratios of 1:2, 1:3.5, and 1:8 (w/w). Triacylglycerol composition, slip melting point, and solid fat content was determined for the raw and fractionated products. Temperature and oil concentration interactions affected stearin yield and physical properties of the product. Stearin fractionated from 1:1 blends contained a higher level of oleo-disaturated triacylglycerols than 7:3 blends. Stearin produced with a 1:8 oil:solvent ratio exhibited better temperature resistance properties. Lower fractionation temperature increased stearin yield.

P-28 Effect of Elevated Drying Temperature on Rapeseed Oil Quality
P.K. Pathak, Y.C. Agrawal* and **B.P.N. Singh**, Centre of Advanced Studies in Post Harvest Technology, G.B. Pant Univ. of Agriculture & Technology, Pantnagar 263145, India

A maximum temperature of 93°C is recommended for drying rapeseed prior to evaluation of oil quality. However, little evidence supports this restriction, and there are no mathematical models available to develop and optimize drying systems for rapeseed. The effect of drying temperature on rapeseed oil quality, total oil content, oil color, and free fatty acid content was determined at various temperatures from 50° to 300°C. The use of thin-layer drying systems above 93°C to reduce drying time, and a proposed mathematical model for this process will be discussed.

P-29 Sorption and Desorption Equilibrium of Defatted Soybean Meal
Y.C. Agrawal*, D.R. Verma and **B.P.N. Singh**, Centre of Advanced Studies in Post Harvest Technology, G.B. Pant University of Agriculture & Technology, Pantnagar, 263145, India

Defatted soybean meal has tremendous potential as a protein-rich human food in India. However, defatted soybean meal is a very hydroscopic product. Equilibrium moisture content is an important factor that influences meal weight and deterioration of product quality during storage and transport. Equilibrium moisture isotherms for defatted soybean meal were determined by sorption and desorption using saturated salt solutions. A mathematical description of these isotherms at 20°, 40°, 50° and 70°C under static equilibrium conditions will be discussed.

P-30 Production of Cocoa Butter Replacers by Fractionation of Edible Oils and Fats
T. Willner*, W. Sitzmann and **E.W. Munch**, Krupp Maschinentechnik Gmbh, Seevestrasse 1, D-2100 Hamburg 90, Federal Republic of Germany

During the past year, Krupp has developed a new process for dry fractionation of edible oils and fats used in the production of confectionery foods. Results show that dry fractionation process gave product quality comparable to solvent fractionation. Discussion will emphasize the manufacture of cocoa butter substitutes using the new process compared to conventional processes. In addition a new plant system will be introduced.

P-31 Isocratic High Performance Liquid Chromatography of Glyceride Mixtures Using Density Detection
M. Mittelbach* and **B. Trathnigg**, Institute of Organic Chemistry, Karl-Franzens University Graz, Heinrichstrasse 28, A-8010 Graz, Austria

A convenient and reliable method is described, which allows the determination of the overall content of diglycerides, monoglycerides and free fatty acids in vegetable oils. Such information is an essential part of quality control. Separation was achieved by isocratic liquid chromatography using a density detector. A combination of a cyano-modified silica column with two gel permeation chromatography columns was used. The response factors were determined experimentally for the pure triglycerides and free fatty acids as well as for the di- and monoglyceride of palmitic acid. Practical examples of the method will be discussed.

Call for Papers

AOCS 81ST ANNUAL MEETING

April 22-25, 1990
Baltimore Convention Center
Baltimore, Maryland

The technical program planning committee for the Annual Meeting of the American Oil Chemists' Society, to be held April 22-25, 1990 in Baltimore, Maryland, is accepting abstracts for papers to be presented during that meeting. Persons wishing to present papers should submit three copies of a 100- to 300-word *Paper Proposal or Abstract* with title, speaker and coauthors clearly indicated using the form provided. Papers are expected to require 20 minutes, including any time the speakers wishes to use for questions from the audience. Please indicate whether the presentation will be a traditional slide and lecture format or a poster presentation. Since there will be limited time for lectures, poster presentations are encouraged. Persons whose abstracts are accepted will be notified early in 1990 by the chairperson. Mail the form with your Paper Proposal or Abstract to:

Gerhard Maerker
Technical Program Chairperson
c/o American Oil Chemists' Society

Paper Proposal/Abstract Procedure

Paper Proposals or Abstracts must be received at the above address by **October 15, 1989**, to ensure consideration for the program. The same form is used for both the Paper Proposal and the Abstract by indicating on the form, or in your correspondence, which you are submitting.

A Paper Proposal is submitted when the research is not yet complete. It describes your basic problem or assumption, what your research will consist of, and what you are trying to learn. It is due in Champaign by **October 15, 1989,** and must be followed with an Abstract after your research has been completed. The Abstract which follows a Paper Proposal is due by **January 1, 1990**.

If your research has been completed, submit an Abstract by **October 15, 1989**. Nothing further will be due from you on January 1, 1990.

It is required that either a Paper Proposal or an Abstract be received in Champaign by October 15, 1989, in order to have your presentation considered for inclusion in the program.

Topics being considered for symposia and regular sessions include these:

Recent Advances in the Biochemistry of Phospholipids
Enzymatic Modification of Fats & Oils
Industrial Uses of Edible Fats & Oils
Impact of New Soy Varieties on Oil and Protein Composition
Solid Phase Extractions
Capillary Gas Chromatography
Engineering for Improved Environmental Control
Metals and Lipid Oxidation
Milk Lipids
Protein-Nutrient Interactions
Effects of Dietary Proteins on Health and Disease
Preparations & Properties of Chemical Modified Proteins
Process Engineering Conditions for the Production of High Quality Seed Proteins
Surfactants — Miscellaneous Topics
Fats & Oils Processing — Modern Practices
Castor Oil
Hyperlipidemia
Applications of Supercritical Fluid Technology
Lipid Oxidative Chemistry
Hexane Quality
Lipids in Cancer
Separation and Purification Processes
Nutrition of Unsaturated Fatty Acids

Check one:

☐ **Paper Proposal***
Due: Oct. 15 with Abstract due Jan. 1

☐ **Abstract****
Due: Oct. 15 or Jan. 1 if Paper Proposal submitted Oct. 15

A PAPER PROPOSAL OR FULL ABSTRACT must be submitted by all potential presenters by October 15. If your research has progressed sufficiently to submit a full Abstract, that is preferred. If your research has not progressed sufficiently to submit an abstract, a PAPER PROPOSAL alone may be submitted by October 15 to give the technical chairperson sufficient information for the tentative program. A FULL ABSTRACT is then due January 1 at the latest.

Session	Time	Number	81st American Oil Chemists' Society Annual Meeting April 22-26, 1990 Baltimore, Maryland	Reference No.

Title of paper:

Principal author: **Telephone:**

Company/Institution: **Telex:**

Address: **Fax:**

Additional Authors: (Please circle speaker's name if different from principal author.) Company or Institution

*Description of what will be discussed in the paper. **Typed doubled-spaced in box below. A useful summary of paper to be presented.

Poster Session
Yes ☐ No ☐

If intended for specific session, please indicate session title and/or chairperson's name.

AOCS 81st American Oil Chemists' Society Annual Meeting
April 22-26, 1990 Baltimore, Maryland

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Abstracts:

Abstracts must be limited to the space provided on the reverse side. Abstracts should be typed and double-spaced.

Delivery Time:

The delivery time for the standard paper is 20 minutes including discussion and question/answers.

Deadline:

The deadline for abstracts for the Baltimore Annual Meeting is January 1, 1990. The program will be arranged immediately thereafter. Your abstract—the original and two copies—must arrive before the deadline.

Acceptance:

The author will be contacted at the earliest possible date with regard to acceptance and scheduling of the paper.

Equipment and Facilities:

Please advise the Program Chairman if you will require any equipment other than a 35mm slide projector. It will be available without request.

Poster Session:

Space will be available for the exhibit of papers by poster and exhibits for authors who would like this opportunity for more personal interaction with interested parties. The display area is accessible and comfortable, but only flat posters and non-electrical displays will be permitted. You will have to provide all materials and equipment and be responsible for everything, including set up and take down. Thumbtacks and tape will be provided. If you are interested in this means of presentation, please check the box on the front of this form. Further information and instructions will be sent.

A PAPER PROPOSAL OR FULL ABSTRACT must be submitted by all potential presenters by October 15. If your research has progressed sufficiently to submit a full Abstract, that is preferred. If your research has not progressed sufficiently to submit an abstract, a PAPER PROPOSAL alone may be submitted by October 15 to give the technical chairperson sufficient information for the tentative program. A FULL ABSTRACT is then due January 1, 1990.

Mail the original and two copies of this paper proposal/abstract form to:

Jerry Maerker
Technical Program Chairman
% American Oil Chemists' Society
P.O. Box 3489
Champaign, IL 61826-3489 USA

To telephone AOCS: 217-359-2344
To telephone Jerry Maerker: 215/247-5800

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AOCS presents outstanding speaker awards at each annual meeting. Criteria used in selecting recipients include technical content, organization of the material, oral presentation and effective use of visual aids. Certificates are mailed to outstanding speakers after the meeting, and the names of recipients are published in the *Journal of the American Oil Chemists' Society*. All deserving speakers are cited.