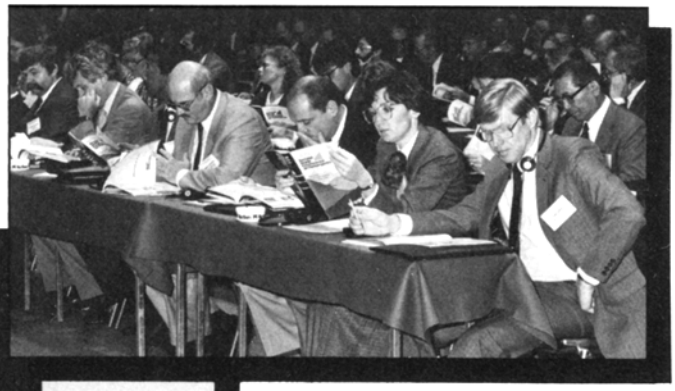
Forty-four speakers from around the world presented the latest available technical information on detergents to nearly 800 technical registrants at the Second World Conference on Detergents Oct. 5-10, 1986, in Montreux, Switzerland. More than 1,000 persons participated in the meeting. A.R. Baldwin, editor of the Conference Proceedings and chairman of AOCS' Publications Committee, prepared the following summary of the technical papers presented. The conference proceedings will be available during the first quarter of 1987. All conference technical registrants will receive a copy; others who wish to receive the hardback volume may order it from AOCS, PO Box 5037, Station A, Champaign, IL 61820 USA. The price is $75 for AOCS members, $95 for nonmembers.

Between speakers, conference participants study the program featuring 44 technical talks and 20 poster presentations over five days of sessions.



During the opening session Monday, Oct. 6, plenary speakers and conference organizers for the 2nd World Conference on Detergents, held in Switzerland, listen to a welcome presented by a member of the Montreux city council.

Technical summary:
Second World Conference on Detergents

Plenary session

In his opening plenary presentation on "Population, Water and Health," Enzo Fano, of the Water Resources Branch of the Natural Resources and Energy Division of the Department of Technical Cooperation for Development at the United Nations, noted that the decade of 1981-1990 was designated the "International Drinking Water Supply and Sanitation Decade." During 1975, 77% of the urban population in developing countries had access to piped water supply (55% with house connections). Of the 75% of the urban population with reasonable sanitation facilities, only 25% were connected to sewers while 50% possessed other household systems, he said. The situation was quite different in rural areas, where 78% of the population were without adequate water supplies and 85% were without satisfactory sanitation facilities.

Improvements have been uneven between urban and rural areas and among geographical regions, but significant progress is being made. Fano said a principal impact during the decade has been the inducement of governments and municipalities to move away from large-scale engineering and construction water projects, i.e., away from approaches typical of industrialized societies. Emphasis has been placed on self-financing, community involvement, training and maintenance of water systems and linkages to primary health care. On the sanitation front, emphasis is being placed on development of low-cost latrines, he said. Progress is being made, but the goals envisioned for 1990 will not be met for at least

Montreux city councilman Marcel Monney, on behalf of the mayor, welcomes participants to Montreux and Switzerland.

Conference chairman Ted Matson of Vista Chemical Co., Ponca City, Oklahoma, USA.

Conference co-chairman Adolf de Jong of Unilever, The Netherlands.

two or three more decades, he concluded.

The "World Economic Outlook" was reviewed by Werner Rein of the Union Bank of Switzerland. We are living in a world with low inflation, low oil prices and low commodity prices, accompanied by serious problems in the debt and labor areas, Rein said. In the United States, the economic performance in 1985 showed a 2.7% growth rate, with a 2.2% growth rate in the first half of 1986. Long-term growth potential is between 2.5% and 3.0%, he said. Temporary deviations are possible but only at the cost of change in the level of inflation, he continued. The 1986 U.S. growth rate is low only because of inventory decreases in the second quarter. Real final sales grew at 6%, which is quite a reasonable performance. Rein expects inflation in the U.S. will be 5% on average next year and even more in 1988 if the Federal Reserve Board does not change its course. A better alternative than inflation to handle the banking problems is deregulation of the U.S. banking system. Other major U.S. problems are the trade and budget deficits. Rein expects progress will be made on both problems with the decline in the dollar affecting trade deficits. He is confident that the turnaround in trade will surprise most analysts next year. The Gramm-Rudman bill is stimulating efforts to lower budget deficits, he noted.

The Japanese economy is suffering from a considerable decline in gross national product (GNP), from 4.5% in 1985 to 2.5% this year—primarily caused by appreciation of the Japanese currency, the yen, against the dollar. There should be a modest recovery next year, Rein forecast. Japan is in the weakest position to resist U.S. suggestions to stimulate the economy. Germany, on the other hand, should be less responsive to the U.S. push for monetary stimulus, he said. Inflation there is almost nil and the intention of the Bundesbank is to keep it that way. To achieve favorable results in the labor market will require some painful changes in German labor laws and union power to make the labor market more flexible.

The political situation in the United Kingdom is more fragile, Rein said. Prime Minister Thatcher's popularity is low, her party is divided and the economic picture only provides good marks for the government with relation to inflation, he said. The economy there is losing steam, unemployment is almost 12% and the British pound sterling is not highly respected. The big risk is that Mrs. Thatcher will compromise with those who want monetary and fiscal stimulation and then lose the election. This worst-case scenario would confirm bond markets, which value inflation and uncertainty very highly in terms of interest rates. The other possibility is that she will not compromise and will win. The chances of either outcome are about equal, Rein said. If she wins, Rein believes, the U.K. financial markets will rally, similarly to the reaction in the United States when disinflation started. In Switzerland, the national bank will continue its target of 2% growth in the monetary base. Switzerland has had a three-year bull market stock exchange with 150% increase, and the bull market is expected to continue, he concluded.

Michael R. Angus, chairman of Unilever PLC, concluded the plenary session with his talk "Dynamics of an Evolving Industry." The world detergents market, which reached $30 billion in 1985, has been growing on a tonnage basis at 4% a year. Many changes are taking place due to competition, innovative cleaning products, new types of products that need cleaning and growth of global markets, Angus said.

The detergents industry has important relationships that must be understood and fostered with suppliers, the distributive trade, advertising and marketing research agencies, product manufacturers (e.g., of textiles and hard surface materials) and equipment manufacturers. Recent environmental challenges are having great impacts on attitudes, trends and even per capita consumption, which has actually been falling in such countries as Austria and Germany,

Angus noted. In the future, the trend in detergent usage will be toward more sophisticated and specialized products, increased consumption in developing countries, more automated and flexible detergent production and packaging operations, and concentration of retail trade into fewer hands, with the consequent opportunity for better sales and inventory information, he said. The environmentalist pressure will not just go away; it must be dealt with in very positive actions.

World trends

Hans-Dietrich Winkhaus of Henkel KGaA opened the session with a report on "Primary Influencing Factors and Major Trends in the European Detergent and Cleaner Market." Europe's diverse community encompasses 17 countries with 400 million inhabitants speaking 20 different languages and residing in cold to warm climates. Such diversity yields varied cultures and consumer behaviors, attitudes and needs. Consequently, there are wide differences in washing habits. Since populations are growing very slowly, e.g., 1.8% total growth is expected from 1984 to 1995, the detergent market (now 9.7 kg per capita per year) will not grow much in absolute terms but will change to respond to specific functional or geographic needs, Winkhaus said. The trend to heavy-duty liquid detergents will be slow; improved formulas and suitable washing machines will be required if consumers are to convert from efficient powders. The trend to higher density powders and phosphate-free products should continue. The European detergent market is dominated by P&G, followed by Lever, Henkel and Colgate, plus small producers with regional significance. Winkhaus forecast that future developments will include increasing consumer awareness of environmental protection, only slow growth in raw materials markets, a trend toward reduced differences in national and regional consumer needs and a slight trend toward more harmony and standardization of products.

In the next presentation, Theodore Brenner of The Soap and Detergent Association (U.S.) described "North American Trends in Soaps and Detergents." The U.S. and Canada produce and consume about one-fourth of the world supply of soaps, detergents and other cleaning agents, he noted. Demand appears steady, although demographic and social trends have reduced the priority consumers place on cleaning and laundering in the U.S., Brenner said. Products are more effective, multifunctional and convenient to use, with a strong trend toward liquids in categories traditionally dominated by powders or solids. Surfactant consumption in household laundry detergents has increased markedly due to the popularity of liquids and the use of cationics as fabric softeners. Detergent phosphates remain a regulatory focus, but new environmental and safety issues are emerging with varying direct and indirect effects on cleaning products, Brenner said.

In a report on "Detergents in Latin America," Albert Hidalgo of Colgate-Palmolive Co. noted that consumption of laundry products in the 33 countries of Latin America, with a population of about 400 million, is about equal to that in the United States. However, the very diverse ethnic customs and economies dictate different mixes of detergent products. Anionic surfactant-based powders and tallow-based bars are the primary detergents wherever most laundry is done by hand and line-dried, he said. Use of brighteners is common but more light-stable ones are needed. Most bleaching is done with low-cost chlorine products. Powdered detergents are often packaged in economical plastic bags, he noted. Heavy-duty detergents are in limited demand due to preference for high foam stability, needed for hand washing. Enzymes would seem to have a good future in Latin America, where there is a high incidence of pre-soaking, he said.

"The Detergent Industry in China" was reviewed by Qin Yong Geng, director of the Shanghai Detergent Factory. Synthetic detergents appeared on Chinese mar-

Enzo Fano of the United Nations, speaking on "Population, Water and Health"

Werner Rein of the Union Bank of Switzerland, speaking on "World Economic Outlook"

Michael R. Angus, chairman of Unilever P.L.C., speaking on "Dynamics of an Evolving Industry"

ket shelves in 1959, and consumption has increased rapidly from 9,500 metric tons (MT) annually in 1960 to 31,000 MT in 1965 and 1,004,500 MT in 1985. Heavy-duty powders comprise 70% of the total, pastes 5% and various liquid detergents 25%, he reported. Recent changes to more synthetic fabrics (up to 50%), increased wearing of light-colored clothes, use of more hair shampoos and rinses, and rapidly increasing use of washing machines have greatly influenced detergent developments. All-purpose laundry powders are thus popular for use on many kinds of fabrics.

He said other new products on the market include liquid shampoos, high bulk density superconcentrate powders, enzymes and disinfectant-containing detergents. Softeners are little used. In the future, the new open policy will hasten modernization by allowing importation of technology and equipment. The new materials development will be shown mainly by increased use of fatty alcohols, he said. Environmental problems are not of great concern now because per capita consumption is still low and phosphate builders are used sparingly.

"Trends in the Soap and Detergent Industry in Japan" was the topic for Moriyasu Murata of Kao Corp. He reported that in Japan, more than 1.8 million tons of household cleaning products were used in 1985, with a total value of 780 billion yen. The market has shifted to biodegradable soft alkylbenzene and nonphosphate builders—mainly zeolites. Washing machines are used in nearly every home, with frequent washes—averaging 2.5 washes a day, six days a week—the norm. Most dishwashing, however, is by hand; thus dishwashing detergent requirements are for low skin irritation. Detergent usage is not expected to increase faster than population growth in the years ahead, Murata said.

Raw materials

"World Petrochemical Feedstocks for Detergents: The Next Decade" was presented by Donald Haupt of Shell Chemical. The paper noted that prices of petrochemical raw materials generally have tracked crude oil pricing during the past 15 years, even though crude prices fluctuated from $5 to $40 a barrel. This trend is likely to continue during the next decade. In response to slower growth and higher costs of the last decade, the petrochemical industry has become a more efficient supplier for the years ahead, he said.

The second paper in the session was "Oleochemicals—Outlook to the 1990s" was presented by J. Knaut of Henkel KGaA. Oleochemicals are the products obtained by splitting and further reactions of oils and fats to produce glycerine, fatty acids, fatty acid methyl esters, fatty alcohols and fatty amines. Since there is an abundance of all kinds of fats and oils and potential production of them is increasing faster than populations, their availability to the detergent industry seems assured at low prices that will be very competitive with petrochemicals into the 1990s, Knaut said. Recent increases in palm oil production should continue but at a slower pace. Lauric oil production has returned to normal after the drought years of 1983–84, so prices of coconut and palm kernel oils are expected to be more stable and lower-priced. The largest volume of oleochemicals, fatty alcohols, goes to the manufacture of surfactants for detergent formulations. Fatty alcohol production in 1985 was 470,000 tons from natural sources and 630,000 tons from synthetics; by 1990 production from each source is expected to be 670,000 tons, he said. There is more than ample oleochemical processing capacity at present, and more is being built or planned.

The challenge for the future is to find new uses for established oleochemicals and to develop new oleochemicals specifically competitive with other types of petrochemicals, Knaut said. Research will continue on breeding and genetic engineering of new oil crops to produce specific oil chemicals for specific purposes, such as jojoba (long chain fatty alcohols), cuphea (C10–C12 fatty acids), sunflower (high oleic acid), euphorbia lagascae (epoxidized fatty acids), high erucic rape (50% erucic acid) and euphorbia lathyris "utopie" (>85% C18). Biotechnology methods in oleochemical processing have many possibilities for biotransformations of fatty acids, e.g., to dicarboxylic acids or introduction of new groups, and for fat splitting, transesterification, selective splitting, synthesis of esters and other uses, Knaut said. The problem will be to find economically competitive new crops and processes. Overall growth in oleochemicals will be only slightly faster than population growth, except possibly in unique products or applications, Knaut forecast.

In his presentation on "Inorganic Raw Materials for the Detergent Industry," G. Bressan of Montedison noted that consumption of tripolyphosphate during the past decade has declined 35–40%, mainly in response to environmental concerns and regulations. Total consumption of detergent phosphates may be stabilizing at around 2.8 million tons during the next few years. Increases in developing countries offset decreases in European and American consumption; world consumption is about 700,000 tons annually. Sodium perborate is used as an internal bleaching agent in detergent formulations. Its bleaching action is increasingly needed to maintain washing efficiency as washing temperatures decrease and amounts of detergent phosphates are reduced.

Reporting on "Sodium Silicates and Sodium Aluminosilicates," George C. Schweiker of The PQ Corp. discussed market volumes and trends of both silicates and aluminosilicates geographically and by product use. More than sufficient capacity exists for both products for the near future, Schweiker said. The three largest uses for sodium silicates are in detergents, catalysts and pigments. Major applications of the aluminosilicates, or zeolites, are in detergent builders and other ion exchange water treatments and in catalysts. The largest use of zeolite NaA is in commercial built detergents because

of its rapid replacement of phosphates in detergent formulations in areas where there were strong environmental concerns. Most rapid growth for zeolites will be in Western Europe through 1990, he forecast.

Equipment/textiles

E.H. Eisele of Whirlpool Corp. presented "A State-of-the-Market Report on Domestic Automatic Clothes Washers, Clothes Dryers and Dishwashers in the United States." Market saturation is 68% for washers, 63% for dryers and 42% for dishwashers, he said. From 1977 through 1985, the industry sold 40 million automatic washers, 29.7 million dryers and 27.4 million dishwashers. The market is growing at about the same rate as the population. There is a trend to a wide variety of new materials and finishes reflecting efforts to reduce costs and to automate the manufacturing process, he noted. Specifically, there is a trend away from porcelain on steel to paint on steel and to plastics. The number of manufacturers continues to decrease—to only four major manufacturers of washers and dryers and six manufacturers of dishwashers. Energy efficiency has improved greatly for clothes washers and dishwashers. Dryers were already very efficient. Trends for the future may be to smaller models, quieter equipment and to electronic sensors, programmers and controls.

The report on "Europe: Washing Machine Evolution" was prepared by representatives of AB Electrolux in Stockholm, Sweden, and presented by Aldo Burello of Zanuss Electrodomestici SpA in Porcia, Italy. Conventional washing machines in Europe are front- and top-load versions of horizontal axis drum systems. Recent trends have been toward faster and lower temperature washings by increasing spin speeds. Consequently, machine manufacturers have been developing washing systems that lower energy and water consumption, reduce detergent usage and make the equipment more flexible. A new washing system called jet system was introduced in 1986 to meet these challenges. The main characteristic of this new machine is washing without water in the tub by recirculation of the detergent liquor, which is heated in a small container outside the drum. Four factors in its operation are shorter times, controlled temperatures, more action of the detergent and more mechanical action. The system reportedly saves 35–60% in electricity, 20–35% in water and 30–70% in detergents. If such a system becomes accepted by consumers, there will be many new challenges for the detergent industry to supply complementary washing compounds.

"Growth and Opportunities in the Textile Industry" were reviewed by Ludwig Rebenfeld of the Textile Research Institute. Textile markets are categorized as (a) traditional (apparel, household and domestic textiles and standard industrial textiles), (b) new markets in fiber composites and geotextiles, and (c) innovative. Total worldwide production has increased from 10 million metric tons (MT) in 1950 to 30 million MT in 1980 and 38 million MT in 1985, he said. Man-made fibers were insignificant in 1940, but now represent about one-half of total fiber production. Fiber use varies with circumstances. Population increases are greatest in developing countries, but per capita fiber consumption is highest in developed nations. Average per capita annual consumption worldwide has increased from 5.6 kg in 1964–66 to 7.0 kg in 1979–80. Textile processing systems have speeded up greatly in recent years, aided by new technologies, melt extrusion and computer-aided design and operations, Rebenfeld said.

Geotextiles, used principally for drainage control and fiber reinforced compositions, are spectacular new outlets for fiber products. Other innovative applications include construction materials and polymeric reagents. Detergents that include surface-active agents relate well to fibers whose distinguishing characteristic is their high specific surface area, he said. In addition to being used for cleaning the ever-increasing amount of textile fibers, surfactants are very important to finish applications. As textile manufacturing speeds have increased, so has the need for better and more specific finishing agents spread by the use of surfactants. New computer-aided techniques have been devised to measure surface coatings on individual fibers and to quantify the distribution of finish add-ons.

Formulation technology: Surfactants in laundry products

"European Laundry Powders—Trends Affecting Active Composition and Performance" was presented by R.V. Scowen of Unilever Research, who noted that many changes have taken place in the European fabric washing market during the past decade. There have been significant switches to lower washing temperatures and to more efficient and environmentally acceptable washing products.

The improvements in washing efficiency at lower temperatures have been achieved largely by optimization of existing technology and exploitation of advanced bleaches and enzymes, Scowen said. The feasibility of formulating products with further significant improvements will require a new, more active system. This, along with growing interest in alternative wash benefits, probably will mean a trend toward more complexity in the active mix or exploitation of compounds with radically different molecular structure.

In a review of "Laundry Products: North American Market Trends and Surfactant Formulation," J.W. Leikhim of Procter & Gamble said that during the past few years, there have been important changes in consumer needs, detergent technology, the grocery trade and corporate strategies. These changes—to cooler wash temperatures, use of heavy-duty liquid detergents, production of low- or non-phosphate detergents, growing use of nonfunctional additives, development of detergent/softener blends, higher density powder products and more specific detergents for specialty uses—characterize today's situation and are expected to continue

into the 1990s. New combinations of current surfactants will be used to enhance the utility of such additives as softeners, enzymes, bleaches and perfumes. The surfactant choice will depend on the cost/performance ratio, he said. The industry will reach for more expensive materials if they bring with them important performance value, Leikhim said.

Akira Mori of Lion Corp. outlined the "Laundry Detergent Industry in the Far East." He explained that detergents have been developed for different Far Eastern countries depending on weather conditions, extent of machine washing vs. hand washing, water hardness, availability of raw materials and local government regulations. Machine washing prevails in Japan (100%), Taiwan (75%) and Hong Kong (70%), using impeller-type machines with ambient-temperature water. In other countries, especially Thailand, Malaysia, Indonesia and the Philippines, most washing is done by hand. Detergent consumption increases linearly with the increase in machine use. There has been a rapid trend in Japan (95%) and Korea (76%) away from phosphate to zeolite detergents.

"Surfactants in Non-Soap Detergent Bars and Pastes" was presented by P.K. Chadha of Nippon Lever, who noted that such products are especially important in developing nations, as the primary laundry wash process is hand laundering. When detergent powders were introduced, their advantages over bar soap were important to consumers. However, the development of non-soap detergent (NSD) bars in the past 15 years has met the needs in hand washing and their volume growth has been good, Chadha noted. ABS is the choice of active surfactant in such bars, based on performance and cost. Factors such as hardness, rate of wear and feel are important for bars, while phase stability and feel are essential for pastes. These desirable characteristics are achievable by proper formulations, such as overcoming LAS-NSD softness by removing the plasticizing water during neutralization and improving the "mush" level by exchanging the sodium cation by potassium. Alternative actives that can be made from indigenous products, i.e., coconut and palm oil and sugar, may need to be considered for economic, ecological or political reasons. Coco primary alcohol sulfate or sulfonate offer the most potential because they can be made water-soluble over the temperature range of normal hand washing.

O.C. Kerfoot of Vista Chemical Co., discussing "Surfactants for Laundry Liquids," noted that heavy-duty laundry liquids have had varied success in different countries. In the United States, they have been very successful, capturing 30% of the market; in Europe, there is only limited success to date; and moderate success has been seen in Japan, at 8.5% of the market. Most liquids contain two or more of the following surfactant types: LAS, AE, AES and soaps. Kerfoot compared the various surfactants as to their performance in liquids. No one surfactant is ideal, but combinations can emphasize the advantages and minimize the disadvantages of each. Future trends will depend on the same types of surfactants, but with different compositions to meet specific needs. Advances in laundry liquids will center on additives such as new enzymes, better softening/antistatic agents, stable bleaching agents and activating agents. New soluble builders or techniques to formulate with traditional builders (e.g., formation of stable vesicles containing STP) are needed to improve tolerance to hard water.

Formulation technology: Surfactants in non-laundry products

"U.S. Dishwashing Products—A Decade Review" by K.M. Fernee of Colgate-Palmolive Co. described the U.S. dishwashing detergent business as a very competitive, mature market with sustained, moderate (7%) growth. It is dominated by Procter & Gamble, Lever and Colgate-Palmolive.

Advances in light-duty liquids have provided improved cleaning and cost effectiveness. Automatic dish detergents (ADD) increased during the decade by 13% annually due to increased numbers of home dishwashers (now at 45–55%), she said. Sales projections for 1989 are $1.17 billion of light-duty liquid detergents and $608 million for ADD. In the past two years, lemon-fragranced ADD products have been marketed successfully. There is a clear trend that formulation development programs for both types of products will be increasingly consumer-driven.

In "European Dishwashing Formulations," Peter Berth of Henkel KGaA continued the discussion of two general classes of dishwashing detergents—light-duty detergent for manual dishwashing and heavy-duty types for machine dishwashing. The efficacy of the first type is based on a surfactant combination supported by mechanical agitation by physical labor so that the clean dishes dry without spots. The efficacy of machine dishwashing detergents depends on interaction of alkalinity, builders, mechanics and temperature. Biodegradabilities of the components of both types are of increasing importance, he noted.

The cost/benefits of each type were compared in interesting charts accounting for costs of chemicals, energy and water consumed. Overall costs for manual and automatic dishwashing are very similar. Trends are toward more automatic washing, further improvements in human and environmental compatibilities and continued optimization of cost effectiveness.

"Surfactants for Household Hard Surface Cleaners" were reviewed by Michael F. Cox of Vista Chemical Co. In general, all household cleaners not made for soft surfaces (e.g., laundry and carpets) or personal care use can be considered hard-surface cleaners. In 1986, more than 2.5 billion pounds of these will be used in the United States. The products come in the form of powders, liquid concentrates, spray cleaners and scouring pads. Market growth has been slightly faster than overall detergent growth as more and more specialty products are produced to solve special cleaning problems, he said. The recent trend has been toward

liquids and away from scouring powders. Cox said the leading volume surfactant in such products is soap, followed by LAS, APE, AE and SAS. These cleaners will continue to be based on current surfactants, but the compositions may vary to meet new and more specific performance needs.

"European Industrial Detergents—Formulating for Performance with Biodegradability" was the topic of W.M.H. Worth of Diversey Ltd. By 1990, all surfactants in the EEC must be biodegradable, he noted. Most European detergents already meet requirements for biodegradability of surface-active components. However, developing complying formulations for some institutional and industrial cleaners and rinse aids has not yet been accomplished without a loss of performance, he said. He suggested that a closer working relationship between detergent formulators and surfactant manufacturers probably will be required if the problems are to be resolved by 1990.

In "Effects of Bar Soap Constituents on Product Mildness," R.M. Dahlgren of Procter & Gamble said objective clinical methods based on controlled applications of formulated soap products to the forearm have been developed and coupled with expert tactile and visual evaluations of smoothness, redness and dryness. Instrumental tests for assessing skin conditions included measurement of transepidermal water loss, surface conductivity, sonic transmission and surface replicate molding. The physical tests could determine differences between formulas and correlated well with dermatologists' evaluations. This test program confirmed a clinical benefit for adding 8-12% glycerine to bar soap and enabled establishing a ranking of surfactant mildness; alkyl glyceryl ether sulfonate was milder than tallow soap, which was milder than coconut soap.

The paper proposed a model for the induction of dry skin based on the tests described. Surfactants in the products penetrate the stratum corneum to the viable epidermis and alter the process of cell differentiation. This causes primary irritation, which shows as skin redness, changes in the stratum corneum lipid composition and perhaps yet undetected changes in corneocytes themselves. The barrier of the stratum corneum is thereby reduced. The result is that it is easier for the surfactants to penetrate the epidermis during future washings, and the moisture content in the upper horny layers decreases due to insensible transpiration. Finally, the scaly rough skin surface traces to the imperfect desquination of the dry non-plastic corneocytes resulting from compromised cellular differential, Dahlgren said.

Implications of this work are that the way to make bar soap products with outstanding skin effects is either to formulate bars with mild surfactant or to formu-

late bars including moisturizers that can be delivered from soap-based cleansing bars to the skin at effective concentrations. Highly glycerinated soaps are partly effective, but the challenge is to find new moisturizers and surfactant systems that the consumer likes and that also provide measurable skin benefits, he said.

Formulation technology: Builder systems in detergent products

The role of "Phosphates as Detergent Builders" was discussed by J. Kandler of Hoechst Aktiengesellschaft. Sodium tripolyphosphate (STPP) is recognized as the most cost-effective builder for washing and cleaning agents. World consumption has remained fairly constant despite the limits on use in some countries, he said. Advantages of STPP as a builder include an excellent safety record, its ability to sequester water hardness ions, its soil dispersing properties and its synergism with surfactant in the wash liquid. Its one problem is that it apparently contributes to the eutrophication of natural waters. The phosphate industry has tried to help on this problem by (a) supporting research on phosphate removal from wastewaters, (b) developing special, more stable grades that allow the use of less phosphate and (c) improving the economics of phosphate manufacturing. These efforts are expected to ensure the long-term use of STPP as the primary detergent builder, Kandler said.

Low proportions of polymers in detergents increase primary detergency and reduce incrustation and redepositions, according to W.J. Wirth of BASF Aktiengesellschaft, in his paper on "Organic Polymers in Detergent Formulations." Polymers also lengthen the life of textiles and washing machines, he added. These effects are particularly pronounced in low-phosphate or phosphate-free detergents. The polymers also can aid processing when added to slurries, he said, adding that they are toxicologically harmless. It is anticipated that polymers will be adopted in many detergent and cleaner formulations throughout the world.

Peter Krings of Henkel KGaA reported on "Possibilities of Combining Zeolite A with Different Co-Builders," describing the increasing use of zeolite A with different co-builders such as citrates, nitrilotriacetate (NTA), phosphonates and polycarbonates. The role of these co-builders as carriers and their threshold effects in zeolite-built detergents was described. Current non-phosphate zeolite-built builder systems reportedly perform equally to phosphate systems in laundry detergents as far as the consumer is concerned, he said.

In "A Comparative Study of the New Builder Systems for Laundry Detergents," R. Gresser of Rhone-Poulenc Chemie discussed the performance of mixed builder systems as possible alternatives to STPP in terms of functional effectiveness as well as cost/performance. At pH 10.5, only NTA and EDTMP are more effective sequestrants than STPP, while at pH 9, the sequestering properties are substantially less than those of STPP, he said. The dispersant power of STPP is greater than that of either NTA or zeolites. Gresser also reported that NTA shows satisfactory incrustration performance; zeolite has a serious incrustation problem; zeolite/NTA formulas perform poorly because of incrustation; and adding a copolymer to the zeolite/NTA formula helps the problem, but not enough to be acceptable. On a cost/performance basis both the zeolite/NTA systems and the zeolite/NTA/copolymers are much more expensive than the straight STPP builder formula. Ecotoxicological problems appear to be absent with the zeolite builders, but the toxicity risks of NTA for man and other living organisms have not yet been fully evaluated, he said. Acrylic-based copolymers have problems of biodegradability. At present STPP still appears to offer the best answer to the three constraints of sequestration, economics and ecotoxicological aspects.

C.A. Houston of Colin A. Houston & Associates discussed the problems of using "Builders in Heavy-Duty Detergents (HDLs)" in the U.S. and Europe. The most difficult problems involve compatibility when combining substantial amounts of organics with electrolytes that tend to salt out the organics. The usual approach is to use hydrotropes and coupling agents, such as sodium xylene sulfonate and ethanol. Regulations are tending to limit the use of phosphates, so formulations using NTA and/or sodium citrate are becoming phosphate alternatives, although neither is as good a builder as STPP. It is expected that market share of HDLs will continue to increase in the U.S., but in Western Europe, unless new technology can be developed to allow incorporation of bleach, HDLs will have an uphill struggle, he predicted.

"Builder Trends in North American Detergent Products" were reviewed by W.W. Morgenthaler of Monsanto Chemical Co. STPP was the dominant builder in the U.S. from the introduction of detergents in the 1940s through the 1960s. Since then, environmental, economic, energy, performance and social factors have affected detergent manufacturers' choices of builder and builder level. In the 1970s, the builder content of typical U.S. consumer laundry detergents was about 46%; today the level is closer to 35% on a total market basis, but still in the 46% range for powders, Morgenthaler said. The decrease was attributed entirely to the growth of liquid detergents.

STPP use has been reduced from approximately 1.6 billion pounds, or 90% of builder volume, to about 650 million pounds, or 38% of the builder mix, he said. The Canadian laundry detergent market of 400 million pounds (8% of the size of the U.S. market) has about the same composition as U.S. products. In 1973, Canadian legislation reduced the phosphate levels to 2.2%, thus requiring formulators to restrict STPP use and add alternative builders such as sodium nitrilotriacetate (NTA), which has become well established in Canadian laundry products. Even though in 1980 the U.S. EPA notified the detergent industry that it saw no reason to

prevent its use in U.S. detergents, it is not being used, primarily because of a ban on its use in New York state, he said. Phosphate legislation does not affect its use where hygiene is essential, such as in dishwashing, hospital, restaurant and dairy cleaners.

Current phosphate usage in powdered laundry detergents seems stable, with some upward potential through new product formulations. However, total STPP usage will continue on a downward trend due to increasing popularity of liquids in the United States, he said. Canadian liquid sales are a much smaller portion of total laundry detergents than in the United States. Other possible builders include NTA, sodium carbonate (which finds relatively little use because of processing and storage properties, solubility and cleaning performance), sodium silicates, sodium citrate and zeolites (which have been used as a cobuilder with phosphates, but the outlook for zeolites in the United States is now limited). Two other alternative builders are carboxymethyltartrate and carboxymethylsuccinate, but these have never really been commercialized.

Consumer desires are toward ease and specificity of use and aesthetics, whereas prior emphasis was on soil removal performance. Thus, there has been a proliferation of new products featuring unique delivery systems, bleach and softening agents.

Formulation technology: Special functions

In his "Introduction to the Session on Special Detergent Functions," R.A. Llenado of Lehn & Find, Sterling Drug Inc., reviewed five special ingredients that, because they are costly and sometimes unstable, require great care when being incorporated into detergents. These are fabric conditioners, bleaches, enzymes, fluorescent whitening agents and fragrances. Each was discussed in detail by the session speakers.

"The Use of Cationic Fabric Softeners in Laundry Detergents in the U.S." was reviewed by J.G. Fuller of Sherex Chemical Co. Fabric softeners were first used in the United States in the 1950s. Since then, performance characteristics have had to include the ability to reduce "static cling." For convenience sake, there has been a recent trend to combination detergent/softener products, now 17% of the total heavy-duty detergent market, and 13% of the heavy-duty liquid market. In general, in HDLs the nonionic/cationic softener products are the best for imparting softness. The detergency of many nonionic surfactants is virtually unaffected, at least in laboratory tests, by the addition of cationic softener, and soil redeposition is actually reduced because of the cationic softener effect, Fuller said. However, fabric treated with products containing nonionic surfactants and cationic softeners has a lower level of whiteness than in a conventional liquid detergent system. Fluorescent whiteners lose some of their effectivenss when added to the combination.

Because of the many possible combinations in heavy-duty powder formulations, no single example suffices. Powdered softener/detergent combinations with anionic surfactants are common. The most widely used softener is distearyl dimethyl ammonium chloride. It was found that rinse cycle softeners give excellent softening action and dryer-added softeners give good softening, while detergent/softener combinations give acceptable softening. With the wide varieties of softeners, surfactants and additives available, it is essential to understand the many parameters available, including particle size, rates of ingredient dispersal in the wash water, interactions of ingredients and rates of softener deposition on the fabrics. The latest detergent/softener products introduced in the United States are nonwoven fabric pouches that contain detergent powder and softener designed to be retained on the nonwoven and transferred to the automatic clothes dryer, where it functions as a dryer-added softener.

Understanding the chemistry involved in the many possible combinations of detergent/softener is a key to better performing and more acceptable products in the future.

Alan Smith of Interox Research & Development discussed "Bleaching Systems." Gradual reductions in washing temperatures have caused a need for changes in bleaching agents, Smith said. Oxygen bleaches in particular become less effective at the lower temperatures. Activator materials for the persalts have come into use, and there are trends toward incorporating peracids directly into formulations, he noted. Photoactivator systems are being used somewhat in countries where there is a lot of sunshine.

Currently available bleaching systems were discussed in considerable detail by Smith. In the future, we may see more stable peroxyacids, mixtures of bleaching agents, use of metal catalysts with persalts, newly designed washers that allow adding the bleach separately, and possibly different packaging to allow the use of bleach in liquid detergents.

The "Development of Detergent Enzymes" was reviewed by P.N. Christensen of Novo Industri A/S, who noted that proteases and amylases have been used in detergents for many years, but recently new proteases have been developed to be more effective at lower washing temperatures. Lipases are now under active evaluation; the latest potential detergent enzyme is a special multifunctional cellulase that has fabric-softening, color-brightening and soil-removing properties in suitable detergent formulations, he said. The new enzymes, combined with genetic engineering in the manufacture of enzymes, offer new opportunities for detergent enzymes with new and improved properties through the 1990s.

U. Schuessler of Bayer A.G. began his report on "Fluorescent Whitening Agents" (FWAs) by observing that they have become standard constituents in modern detergent formulations, but have not changed much during the past decade and few, if any, new ones are expected in the foreseeable future.

The diaminostilbene disulfonic acids constitute the largest class of detergent whiteners. The pyrazolines and coumarins are used primarily in light-duty detergents for polyamides and wool. FWAs are only suitable for polyamides and cellulosics. Suitable FWAs do not exist for polyester and polyacrylonitrile. Detergent FWAs have been proven to cause no toxicological or ecological problems, he said, but the high cost of testing and registration will limit if not prohibit the development of new FWAs.

Don Stagg of Givaudaun S.A., speaking on "Detergent Fragrances," stressed that although fragrances are nonfunctional in a detergent formula, they are very important elements in the marketing mix, as they can differentiate one detergent from another and underline marketing claims of the products. Detergents are chemically active, so the perfume must be physically and chemically compatible with the bases used. Fragrances have advanced from the single aromatic mixtures of the pre-1970s to fragrances approaching aesthetically the level of cosmetic perfumes. European fragrance trends have changed considerably during the past few years and are expected to continue to change, depending on economic situations, environmental concerns, consumer habits, development of new synthetic textiles, the form and formula of future detergents and the synthesis of new aroma chemicals, Stagg said. Fragrance can sometimes make the difference in the market success of detergents, and good communication between the fragrance formulator and detergent formulator is essential to that success.

Processing/packaging

In the talk "Tower Powder Making and Process Control," Peter M. Nightingale of Cornwell Products Ltd./Mazzoni described the Mazzoni complete detergent manufacturing process from handling of raw materials to the production of finished products ready for packaging.

Unit processes include sulfur burning and conversion to SO_3, sulfonation and sulfation in the multitube falling film reactor, neutralization, slurry preparation of detergent formulas, tower spray drying and postblending of heat-sensitive materials. Heat conservation, especially from the burning of sulfur, the sulfonation operation and tower spray drying, is essential to low cost operations, Nightingale stressed. Also, extensive computer controls are offered to provide a complete detergent factory with any extent of automatic operation and monitoring that may be desired.

"Detergent Packaging" was reviewed by R.W. Coughlin of Pneumatic Scale Corp., who described packaging liquid and powdered detergents in plastic bottles and powdered detergents in cartons and plastic bags. During the past 80 years, since the first automatic packaging line for soap in the United States was put into operation, lines have been made faster, more accurate and flexible, able to handle different shapes and foamy detergents and even able to fill bottles in their shipping containers.

A recent development for filling liquid detergents has been a combination filler that fills to a level in clear plastic bottles but does volumetric-based filling in opaque bottles, all at speeds of 400 units per minute, he said. Larger sizes, odd shapes, foamy detergents, dripless pouring spouts and large measuring caps all restrict speeds. Another significant recent development is line control and monitoring with programmable logic controllers (PLCs) and computers. With all use of control functions and the probability of in-line blow molding and in-mold labeling, we are approaching "in-the-dark" bottling lines, which implies complete automation with absolute minimum line supervision, he said, adding that this would mean lower costs and higher productivity.

Research and consumer interface

"Environmental Political Aspects of Washing and Cleaning Agents" were reviewed by H.F. von Lersner of the Federal Environmental Agency (FEA) of the Federal Republic of Germany. The use of washing and cleaning agents is absolutely essential, but since there are no perfectly environmentally compatible detergents and nearly all washing wastes make their way into our water bodies, there is a need for political action, preferably with full cooperation of all parties concerned, to minimize any harmful effects on the environment, von Lersner said.

It is prudent not to use detergents any more than necessary—good hygiene does not mean sterility, he commented. The introduction of new products or additives should be timed to allow science and politics to test their environmental compatibility. Parameters for assessing a new detergent or cleansing agent include hygiene, effects on laundry equipment, water and energy consumption and product cost, he said. Washing machine manufacturers should develop machines that soften water to reduce detergent dosage and that are "intelligent" enough to inject components of detergents only when they are needed for a specific part of the wash cycle. The closer detergent manufacturers and merchants cooperate with public authorities in the development and marketing of their products, the less need there is for public authorities to interfere in the marketing or use of such products, he said. The preventive approach in environmental policy is far better than corrective legislative action.

The first West German detergent law was passed in 1961 and dealt with biodegradability, he noted. In 1975, the Detergents Act gave the government authority to determine maximum amounts of phosphates and to restrict or prohibit the use of other substances if such substances were detrimental to water quality. Also, manufacturers were obliged to print content analyses and dosage recommendations on labels and to provide the general formulas of each washing and cleansing agent. This procedure enabled the FEA to submit to the government recommendations for ingredient or product prohibitions and restrictions. The FEA now has stored in its computer

approximately 17,000 formulas for about 600 products. Confidentiality of the information is assured, he stressed.

The relationship between "Social Changes and the Detergent Environmental Conflict" was described by Wouter van Dieren of the Institute of Environmental Systems Analysis in The Netherlands. Detergents and related products are being depicted as symbolic targets for environmental action despite improvements in their environmental safety, he said. Four major causes of this are (a) coincidental development of early environmental awareness and public perception of detergent foams on surface waters; (b) the role of eutrophication being the first widely perceived water pollution, with this perception eventually evolving into the first institutionalism involving science, legislation, politics and activism; (c) the early role of the detergent industry in these conflicts being defensive, or aggressive, with a convince-and-win attitude; and (d) the role of advertising.

Detergent advertising has continued to play a catalyst role in conflict generation by inflating the concept of innovation, by motivating emancipatory movements against the detergent business and by failing to communicate the role of detergents in promoting good hygiene, he said. It appears that internal management mechanisms in the industry are not properly adapted to the challenges of a changing society, van Dieren suggested. Dominance of the marketing culture over the R&D culture keeps creating tensions in the development of effective strategies. In the future, conflicts are expected to continue over phosphates and eutrophication, particularly in countries such as Spain, Mexico, Greece and Brazil, where consumer concerns are just evolving.

There is a shift from research and concern over hydro-ecosystems to aquatic toxicology, and really to overall water scarcity, he said. Since all detergents eventually end in surface waters, the detergent industry has a choice to become either a target or a partner in the politics of water scarcity, he concluded.

R.J. Duggan of Unilever discussed "Research and the Consumer Interface: The Industry Viewpoint." Service to the consumer, at a risk, for a profit is the role of business in society, he said, and industry is the major wealth producer for society. The detergent industry exists to serve the consumer by making available products that provide consistent standards of cleanliness, hygiene and care toward fabrics, household equipment and consumers themselves, he noted. The industry is well experienced in understanding direct consumer needs and in delivering products to meet these needs, but it is less expert in dealing with the ever-increasing and more indirect demands from society. If the detergent industry is to serve society long-term, it has to pay attention to the needs for both the physical environment and the attitudes of society. To do this, good communication should be developed in a partnership of the industry, governments and parties with environmental or safety concerns.

Problems such as banning phosphate and NTA, a need to improve products, a need to change products' overall environmental compatibilities and issues such as "freedom from additives" could be resolved much better if there were consensus among all the parties concerned, he said. Finding solutions to such problems requires establishing an arena in which more mutual respect is created among the potential partners, starting particularly in the relationship between industry and educators.

Duggan proposed the following action plan: (a) industry must decide what it wants to say and to whom; (b) key priorities for dialogue must be established; (c) partners must be identified and a skillful process of courtship pursued; (d) industry should provide real experts and expertise for joint study of key problems; (e) industry must work for acceptance of realistic environmental risk assessment as a key aspect of decisions by society to regulate materials on environmental grounds; (f) funding and farsightedness must be provided by industry; and (g) industry must work at the educational level to get a much better long-term understanding and acceptance of the role and value of both industry in general and the detergent industry in particular as part of the educational curriculum.

N.A. Staples of A.C. Nielsen Co. Ltd. began his review of "Marketing Changes" by noting that since world populations are growing at 1.8% a year and the world is "becoming smaller" every day due to the acceleration in travel, communications, technology, information handling, competition and growth of multinational firms, the drive for global marketing also is accelerating. Successful global marketing is founded on sound local practices that reflect local needs and conditions. The more successful marketers are those who achieve a geocentric balance by realizing the benefits of global scale, avoiding threats of local "niche"-type competition, and satisfying variable needs of a vast and disparate population of customers, he said. Obviously, the more market data and analysis that a company has available through such data bases as Nielsen Research develops, the better able it should be to develop its global marketing strategies.

"Consumer Interface: Retailing," by Jean-Francois Domont of DIA Group Pomodes, covered retail distribution, the last step in the industrial process chain from raw material to end user. Today, retailing is characterized by larger stores and a shift to greater capital intensity. Scale of operation is just as important to reduce unit costs in the retail business as in the large national and international detergent companies.

Previously the detergent industry usually had more negotiating power than the retail industry, and it seemed that retailers tended to use most of or even more than their margins in detergent sales to support come-on-in advertising, he said. The consequence was that detergents were considered low-profit items by retailers. However, as retailers are getting more so-

phisticated in cost analyses and control, they are becoming more sensitive to ways to reduce handling costs. Some methods are through more concentrated formulas, more compact packaging, pallet storage and stacking, and regular and dependable delivery from suppliers to the retailer's warehouse. Increased cooperation between detergent suppliers and retailers can be advantageous to both, Domont said.

Poster presentations

George T. McGrew of Alco Chemical Corp. discussed "Polymers as Antiredeposition Agents." Tests of carbonate detergent formulations were made on the effects of three carboxyl-containing copolymers of acrylic acid with different molecular weights as antiredeposition agents for red and black iron oxides on cotton and polyester fabrics. The polymers were effective at 20 ppm levels. There was not much effect of molecular weight of polymers on cotton fabric, but the higher molecular weight product worked better on polyester fabric. Optimum pH for antiredeposition in the cases studied was 10.5.

In his presentation on "Fabric Softeners," R.A. Reck of Akzo Chemie America described the development of fabric softeners from their first introductions in the early 1950s to present day products developed specifically for liquid detergent/softener/antistat products. Dimethyl dihydrogenated tallow ammonium chloride is the original rinse cycle softener and still the most widely used. Imidazolinium and alkoxylated amidoammonium compounds were developed to lower melting points and costs for the rinse cycle softeners. Ethoxylated quaternary ammonium compounds were developed to add antistat properties. Dryer cycle softeners, introduced in 1969, are based on impregnating a substrate with a combination nonionic transfer agent and quaternary ammonium compound. Wash cycle detergents containing softeners involve the use of compatible cationic softeners and anionic surfactants. Use of hydrophilic substitutions into the cationic molecule solved most of the formulation problems. Recently quaternary ammonium compounds have been used to enhance detergency. The technical explanation for this is the adjustment of the CMC level by the combination of nonionic and cationic surfactants.

G. Moretti of Ballestra SpA presented "SO_3—Sulfonation Technology for Surfactant Specialties." Natural petrosulfonic acid is usually a long chain alkylarylsulfonic acid with at least 20 C in the alkyl chain. Synthetic petrosulfonic acid has a dialkyaryl structure wherein the two alkyl radicals should contain at least 20 C atoms. The "natural" products are made by direct sulfonation with SO_3 either in gas or liquid form. The Sulfphonex system provides SO_3 directly from elemental sulfur. Sulfonation can be done in a cascade stirred vessel system, in a multijet system or in a multitube film reactor. The choice of systems will depend on raw materials to be sulfonated and the qualities of desired products. Extraction of the petrosulfonic acids from reaction mixtures can be done efficiently with anhydrous methanol. Neutralization can be done in the methanol or by a double step "Neutrex" neutralization process. Detergent specialities can be made from detergent alkylates, fatty alcohols, ethoxylated fatty alcohols, alpha olefins and fatty acid methyl esters by continuous SO_3-sulfonation in the multitube falling film reactor followed by neutralization in the Neutrex system. High quality products can be obtained because both the reactions can be carefully controlled.

"The Saponiflex Process for Manufacture of Soaps and Detergents" was explained by R.J. Bertozzi of The Dial Corp. The process can saponify fatty acids or fats and oils and blend the soaps conveniently into pellets, powders, formulated soap bases, household laundry and detergent products or custom blends in a versatile single unit operation. The process can be adopted from 5 lb/hr (pilot plant) to 10,000 lb/hr or anywhere in between. The single unit operation offers a great deal of flexibility, low capital and operating costs, minimal space requirements and simplicity of operation, maintenance and formula changes.

D.P. Bauer of Ethyl Corp. discussed "Di-N-Alkylmethylamine Oxide: I Didecylmethylamine Oxide Compared with Stearyldimethylamine Oxide." Didecylmethylamine oxide (a new compound) and stearyldimethylamine oxide are closely related, but their physical and general emulsification properties are quite different. This difference is discussed in terms of their differing molecular geometries. Spacefill representations suggest that a greater stearic hindrance about the N-O group on the dialkylamine derivatives could suppress access of polar molecules to the N-O functionality, thus reducing the hydrophilic interactions.

"Environmental Aspects of Cationic Fabric Softeners" was presented by G.H. Taueber of Hoechst AG. About 15,000 tons/yr of distearyldimethyl ammonium chloride is used in West Germany, he said. Laboratory and field tests indicate that sewage treatments eliminate 95%. Surface waters show only 10 micrograms/liter of cationics. This is the limit of detection. Residual amounts of DSDMAC in bio-sludge do not represent any negative influence on soil respiration.

Salmiah Ahmad of the Palm Oil Research Institute of Malaysia exhibited a poster on "Improvement of Whiteness of Palm Oil-Based Soap and Color Stability of Fatty Acids." Palm oil and palm oil products generally do not produce exceptionally white bar soaps compared to those made with tallow. Several treatments of the palm products were tried on both laboratory and pilot-plant scale to improve the color stability of palm-containing soaps. Bleaching was not effective, but hydrogen peroxide treatment followed by acid and water washings was found to be the most effective in improving the degree of whiteness of soaps and the color stability of fatty acids from palm oils.

"Polymeric Antiprecipitant Systems for Household and Industrial Detergents" were evaluated by Paolo Zini of Rohm & Haas. Water-soluble acrylic-based ho-

mopolymers and copolymers were shown to reduce precipitation of Ca and Mg salts when used in low (10–20%) TSPP + carbonate builder systems. A formulation of 20% STPP, 5% carbonate and 3% modified polyacrylate more than compensates for the loss of antiprecipitation ability of a 30% STPP formula. Likewise a formulation containing 10% STPP, 5% carbonate and 3% polymer restores the precipitation pattern of a 20% STPP formulation. However, no polymer addition to 10% STPP could restore the precipitation patterns of 30% STPP.

B.V. Vora of UOP Inc. discussed that firm's process for "LAB Production." Linear alkylbenzene (LAB) is the most cost-effective active ingredient for detergent technology. UOP has developed—and continues to improve—a successful process for producing them via their Molex, Pacal, Detergent Alkylation unit operations. Advantages ascribed to the process include increased LAB yields, improved product quality and lower costs. A total complex to produce 50,000 MT annually of LAB would cost $48 million in 1986 dollars. Production costs, including raw materials, were estimated at $633 per MT of LAB. Total worldwide LAB production in 1984 was 1.40 million MT, of which 650,000 tons was by the UOP process. Most (86%) of the new production in 1976–81 was by the UOP process. The trend is expected to continue. Total LAB production by 1988 was was projected to be 1.6 million MT.

N.F. Borys of Horizon Chemical Division of A.E. Staley presented "Alkyl Polyglycosides: New Surfactants that Meet Detergent Industry Needs." Alkyl polyglycosides, which can be made from abundant supplies of natural raw materials (fatty alcohols and starch-derived carbohydrates) were shown to have good surfactant properties. They were very water-soluble, with no gel point or inverse cloud. However, they do exhibit surfactant properties similar to alcohol ethoxylates. Such polyglycoside surfactants have good electrolyte tolerances and stability at high and low pH. The alkyl polyglycosides provide stable foams and good lime soap dispersibility. They are relatively nontoxic, completely metabolized in the body, and have low skin irritation values. They are completely biodegradable in the environment.

"Liquid Laundry Detergents Containing Proteases" was contributed by researchers from the Fat Industry Research Institute in Rakovnik, Czechoslovakia. Heavy-duty liquid detergent compositions without STPP have been formulated. Sequestrants to replace STPP are ethanolamine salts of NTA (EA-NTA) and the trisodium salt of the monododecylamide of ethyl-

ene diamine tetracetic acid (DDA-EDTA). Both products give liquids up to 70% concentration in water, their pH values can be adjusted easily, they are good chelating compounds and they are miscible with other HDL ingredients. They offer good enzyme stability during use and storage. Washing performance of detergents containing these compounds as builders was shown to be equal to a conventionally built commercial powder and HDL.

E.T. Messenger of Albright and Wilson Ltd. presented "Application of Spherulitic Surfactant Phases in the Formulating of Built Laundry Detergents." The addition of electrolytes such as sodium carbonate to LAS-based surfactant/water systems causes the surfactant to be forced out of solution in the form of spherulites in the micron range. The spherulites flocculate but do not coalesce and do not separate on storage or centrifuging. Such spherulitic systems are suitable for formulating HDL detergents. Builders such as STPP or zeolites can be suspended in the systems or, alternatively, soluble builders including sodium citrate, sodium carbonate, sodium silicate or NTA can be used to achieve the electrolyte effect on which stability of the systems depends. Solvents, hydrotropes and polymeric suspending agents are not required.

"Improved Sulfonation Plant Pollution Control via Second Generation Electrostatic Precipitator" was the topic for B.W. MacArthur of Chemithon Corp. Tail gases from sulfonation processes contain residual sulfur oxides, spent process air and liquid particulates in the particle range of 0.1 to >1.0 micron. Clean air regulations stimulated use of electrostatic precipitators to remove the particulates. First generation precipitators were of wire electrode design. Improved collection efficiency was achieved by a new electrode disk geometry that sustains much greater average field strengths. In a direct comparison test in a plant using the wire electrode design with a particulate discharge of 70 mg/m^3, the new disk design reduced the discharge to 5 mg/m^3.

In his report on "The Effect of Molecular Weights of Surface Active Agents upon the Stability of Dilute Aqueous Solutions of Sodium Hypochlorite," P.J. Corbett of Dow Chemical Europe reported that there seems to be some correlation of the molecular weight of surfactants and the rate of decomposition of sodium hypochlorite in dilute solution.

"Removal of Fat From Hard Surfaces by Surfactants Studied by Ellipsometry" was discussed by Kjell Bäckström from the University of Lund. Ellipsometry is an optical method that uses the change of state of polarized light caused by a thin film on a reflecting surface. The measured parameters can be used to evaluate refractive index of the film, its thickness and the amount of deposited materials. The kinetics of the cleaning process can be readily followed. A typical cleaning curve vs time shows first some adsorption of the surfactant on the fatty film, followed by a decrease in film thickness showing removal of fats. Removal of tripalmitin starts below CMC, increases near CMC and reaches a plateau; for liquid trioleum, the increase in removal continues at higher concentrations. Fat removal by nonionic surfactants with different EO chain lengths showed that optimum chain length for removal of triolein is about eight and for tripalmitin on PVC surfaces is about six. For tripalmitin on chromium, it is above nine. Chain lengths below five show little or no cleaning effect.

J.H. van Ee of Gist Brocades N.V. discussed "Maxacal, A New Low-Temperature Detergent Protease." The trend toward laundry washing at lower temperatures and higher pH values has encouraged development of new enzyme systems. Gist Brocades has produced a highly alkaline protease from a special strain of alcalophylici-bacillus. The enzyme, called Maxacal, is an endopeptidase belonging to the group of serine proteases. Its activity ranges from pH 8 to pH 12, with optimum at pH 10.5 to 12. The optimal temperature is between 50 and 60 C, but there is appreciable activity down to 30 C. Stability under European wash conditions is good, i.e., residual activity of over 60% after 60 min at 40 C and pH 10. Maxacal is a prilled formulation that can be stored at 25 C and relative humidity of 50% for at least a year.

"Low Temperature Bleach Activators" was the topic for A.T. Gradwell of Warwick International. Sodium perborate is the preferred oxygen bleach in modern powder detergents because of its price availability and stability. However, it contributes significantly to bleaching only at higher temperatures such as above 75 C. The trend to lower wash temperatures spurred the development of bleach activators which, by virtue of reacting with the primary oxygen bleach compounds, generate a secondary bleaching species that is much more effective than perborate at lower temperatures. These activators that have attracted commercial interest are tetraacetylethylenediamine (TAED), pentaacetylaglucose (PAG), and tetraacetylglycoluril (TAGU). All three liberate the peracetyl species, which functions effectively at wash temperatures as low as 40 C. TAED is the most commercially successful because of its cost-effectiveness.

Local chairman Kurt Gehri talks with Giovanni Montorfano of Milan, Italy, between technical sessions.

SDA to hold annual meeting

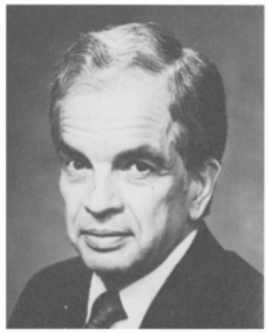
The Soap and Detergent Association's (SDA) 60th annual meeting will feature national and international issues ranging from tax reform to trade policy, as well as key cleaning products industry topics. The meeting will be held Jan. 29-Feb. 1, 1987, at the Boca Raton Hotel and Club, Boca Raton, Florida.

Technical topics will be covered during concurrent sessions Saturday, Jan. 31. Scheduled speakers include Michael J. Dolan of Monsanto Chemical Co., reviewing detergent agglomeration technology; Charles W. Holland of Qualpro Inc., speaking on the role of statistical process control in an environment of continuous improvement; Edward Charles Leonard of Humko Chemical Division, Witco Corp., discussing low and high tech oleochemistry; Werner P. Meier of The Procter & Gamble Co.'s Professional and Regulatory Services in Germany, Austria and Switzerland, speaking on regulatory and professional topics in the European detergent industry; and Karl T. Zilch of Emery Chemicals, reporting on the effect of additives and fatty acids on soap bars. The concurrent sessions also will feature papers on eye irritancy presented by representatives of The Procter & Gamble Co. and the Colgate-Palmolive Co.

Karl T. Zilch

Werner P. Meier

E. Charles Leonard



Nontechnical speakers scheduled include Admiral Bobby Ray Inman, president, chief executive officer and chairman of the board of directors of Microelectronics and Computer Technology Corp., a joint research venture formed by a number of U.S. corporations in that industry, and Lee Sherman Dreyfus, president of the communications firm Lee Sherman Dreyfus Inc. A debate on tax reform and trade policy, slated for Friday morning, Jan. 30, will include U.S. Representatives Bill Frenzel (R-Minnesota) and Thomas J. Downey (D-New York).

For more information, contact SDA, 475 Park Ave. S., New York, NY 10016.

China symposium

A China National Symposium on Natural Base Cleaning Products and Personal Care Products will be held March 18-21, 1987, in Guangzhou, Canton, China. Sponsors are the National Renderers Association, the Ministry of Light Industry of the People's Republic of China, the Guangdong First Light Industry Bureau and the Research Institute of the Daily Chemical Industry.

Speakers will include representatives from companies from the United States, Sweden, Italy, France, West Germany, Spain and India. Topics planned are current research and use of natural base surfactants; fatty acid production; comparison of processes to produce amines/cationics from different raw materials; process for producing unsaturated fatty alcohols; comparison of different methods of soap production; prospects for powdered natural soap cleaning products and sulfonated fatty acid methyl ester cleaning products; and development of catalysts for condensation of fatty acid with ethylene oxide.

For further information, contact Phillip Laney, National Renderers Association, 27E Kam Kin Mansion, 123 Caine Rd., Hong Kong, or Lee Wayne, National Renderers Association, 2250 E. Devon Ave., Des Plaines, IL 60018 USA.

IFSCC congress

The International Federation of Societies of Cosmetic Chemists (IFSCC) held its 14th international congress Sept. 16-19, 1986, in Barcelona, Spain, with over 1,300 delegates from 30 countries participating.

The scientific program, Cosmetics: New Trends in Research and Technology, included sessions on advances in assays and analytical methods for cosmetics, cosmetic hair products, cosmetic science and technology, cutaneous biological approaches and surfactants in cosmetic science.

At the federation's council meeting, IFSCC approved membership for the New Zealand Society of Cosmetic Chemists as its 26th affiliate.

Officers and presidium members elected for 1986-87 were the following: J. Puig Martin of Roure Bertrand Dupont, Spain, president; Saburo Ohta, Japan, immediate past president; L. Motitschke, West Germany, vice-president; R. Luks, Switzerland, treasurer; G. Aubin, France, honorary secretary; committee members P.J. Rothwell of Great Britain, R.F. van Crooneborgh of The Netherlands, Gail Bucher of the Gillette Co., United

States, and M-L Varjovaara, Scandinavia; honorary auditors A.J. Tyler of Great Britain and S. Melis of Italy; N. Avalle of Switzerland, central coordinator; K.V. Curry of Great Britain, education secretary; and Jose J. Perez of Maprin Ltda., Chile, public relations secretary. Members elected to the advisory committee to the presidium were J. Rubin of Argentina, Henry F. Maso of Amerchol Corp., United States, G. Aubin of France, G. Linder-Henell of Scandinavia and V. Lodi of Italy.

Oleochemical officers

The ASEAN (Association of South East Asian Nations) Oleochemicals Manufacturers Group (OMG) has elected the following officers: Roy De Vries of Malaysia, chairman; Alfredo D. Yniguez Jr. of the Philippines, vice-chairman; Tatang Suhenda of Indonesia, Mohd Kassim Salleh of Malaysia and Mokund S. Rao of Thailand, board members.

ASEAN is an economic union comprised of Malaysia, Singapore, Thailand, Indonesia and the Philippines. Oleochemical manufacturers in these countries are eligible to join ASEAN's OMG. Companies that have already joined OMG include the following:

- Malaysia—Acidchem (M) Sdn. Bhd., Henkel Oleochemicals (M) Sdn. Bhd., Malaysian Oleo Chemicals Sdn. Bhd., Southern Acids (M) Sdn. Bhd. and Unichema Malaysia
- The Philippines—Colgate-Palmolive Philippines, D.N.L. Industries Inc., Pilipinas Kao Inc., Proton Chemical Industries Inc. and United Coconut Chemicals Inc.
- Indonesia—P.T. Cisadane Raya Chemicals and P.T. Sumi Asih
- Thailand—Imperial Industrial Chemicals (Thailand) Co. Ltd.

News briefs

As part of its acquisition of Onyx Chemical Co., **Stepan Co.** has made the following appointments: William F. Mailloux and Jim L. Morrow, quaternary cationic sales representatives in the midwestern U.S.; Donald F. Greene, quaternary cationic sales representative in the eastern U.S.; William D. Dunivan, quaternary cationic sales representative in the southern U.S.; Ernie C. Felton, quaternary cationic sales representative in the western U.S.; Frederick G. Rehbein and Burton M. Like, product managers at Maywood, New Jersey; Lorraine D. Lillis, product and regulatory affairs coordinator; Myron A. Frank, director of marketing for industrial chemicals; and Veronica M. Benson, manager of regulatory affairs.

The **PQ Corp.** has appointed Joseph M. DiBussolo project marketing manager in its corporate development division.

William J. Wheeler has been named manager of FMC Corp.'s phosphorus chemicals division, while **David D. Eckert** has been named to the newly established position of general manager, specialty chemicals and group development, for FMC Corp.'s chemical products group.

Shering AG West Germany has sold its subsidiary Nepera Inc. of New York to **CasChem Group Inc.** of Bayonne, New Jersey. Nepera will continue to sell its products in Europe and other defined countries through the Schering AG sales organization and to market Pyridine supplied by the Schering AG plant in Bergkamen, West Germany. It will operate as a wholly owned subsidiary of CasChem Group Inc., with its headquarters in Harriman, New York.

Procter & Gamble, the largest U.S. producer of glycerine, has announced plans to increase its glycerine refining capacity to almost 200 million pounds annually, from the current 110 million pounds.

Kenobel AB has acquired 37.5% of the share-capital of the United Kingdom-based specialty chemicals manufacturer **Amphoterics International Ltd.** Amphoterics International produces amphoteric surfactants for use in shampoos, laundry detergents and household and industrial cleaners. Eric Lomax, founder and managing director of Amphoterics International, retains shares equal to those of Kenobel.

Obituary

NIKOLAUS A. SCHÖNFELDT

AOCS has been informed of the death last year of AOCS member Nikolaus A. Schönfeldt of Mölndal, Sweden. He had been a member of AOCS since 1955.

Schönfeldt earned a doctorate degree from the University of Berlin in 1926. At the time he joined AOCS, he was chief of research at Berol Aktiebolag, Mölndal. His experience included work with surface-active agents, textile auxiliaries and ethylene oxide adducts.