



Shell Development Company's Westhollow Research Center, which opened in 1975, occupies 200 acres near Houston, Texas.

Shell Chemical: key role for R&D

The following article, contributed by Shell Chemical Company and Shell Development Company staff, is the third in a series of JAOCS articles focusing on the research activities of various surfactant and detergent companies. The article was prepared at the request of Arno Cahn, Associate Editor for JAOCS News for Surfactants and Detergents.

Shell Chemical Company began producing detergent alcohols and surfactants in the U.S. in the mid-1960s. In the ensuing 25 years, consumption of alcohol-based surfactants has grown dramatically. Today such surfactants find broad application in consumer detergents, toiletries, institutional cleaners and a myriad of industrial processes. Shell's detergent business has grown dramatically too—today its Geismar, Louisiana, plant located about 30 miles south of Baton Rouge on the Mississippi River is the world's largest production site for linear detergent range alcohols and ethoxylated alcohols.

"Research has played a key role in the success of our business," according to Don Haupt, general manager for Shell's detergent & EO/EG products business. "Process research and development have provided us with innovative manufacturing technologies. Applications research has been essential when

qualifying our products with customers and assisting them to develop new formulations and end-uses."

Shell Development Company, the research arm and a division of Shell Oil Co., performs the R&D needed by Shell Chemical. It operates two major laboratories in the Houston, Texas, area. Westhollow Research Center, a sprawling complex opened in 1975, is located on approximately 200 acres 20 miles from downtown Houston on the city's rapidly developing west side. Programs carried out there support not only Shell's chemical business but also cover a wide range of other activities including oil refining, coal gasification, fuels, lubricants, engineering, environmental and corporate research. Westhollow's roughly 600 scientists and engineers are supported by approximately 700 technical and services personnel. The smaller Bellaire Research Center, in suburban Bellaire,

provides R&D support to Shell Oil's exploration and production businesses.

"One of the advantages a major research center offers is access to a wide range of disciplines, making possible the cross-fertilization of ideas," according to Peter Glockner, director of industrial chemicals R&D. "It is one of our key challenges as research managers to provide an environment where that synergism can flourish. Looking at the R&D programs we are carrying out for the detergent products business, I believe we are harnessing that horsepower and bringing it to bear quite successfully. For example, our detergent R&D teams draw heavily on Westhollow's state-of-the-art skills in catalysis, analytical chemistry and environmental sciences."

Since its inception, Shell's detergents business has been a strong sponsor of research, seeing it as a vital strategic element for long-term success. "In addition to providing the funds, we must also work hard at communications," according to David Scharer, manager of R&D/business integration for the business. "Our business manage-

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ment consistently has maintained a high visibility within the R&D organization at both the professional and management levels. It works hard at communicating the state of the business, long- and short-range plans, business objectives and research needs that result from them." R&D managers are no strangers in the business office in downtown Houston, being regular participants on the business management team. "While the proximity of research and business offices has its dangers, on balance I believe the increased opportunities for dialogue are extremely beneficial to us," Scharer said.

Proprietary manufacturing technology lies at the heart of the company's success in detergent alcohols and ethoxylates. Shell's researchers invented and developed three key chemical process technologies. These complement each other and have been built into an integrated manufacturing complex at Geismar. There are units that take ethylene, the basic petrochemical building block, and grow it to form olefins with longer carbon chains. Other units convert those olefins in the detergent range to alcohols and oxidize ethylene to ethylene oxide (EO). Finally detergent alcohols and EO are combined to produce ethoxylates.

The Shell Higher Olefins Process (SHOP) is the primary route to linear olefins. Almost 10 years in development, the process was first brought on-stream at Geismar in 1977. A second unit just started up this past summer. Shell Chemicals UK operates a third SHOP plant at Stanlow, United Kingdom (U.K.).

SHOP is a complex multistep process. In the first stage, ethylene is oligomerized—grown into longer carbon chains—in the presence of a proprietary metal-ligand catalyst system. A broad range of linear alpha olefins is produced. Most of the C6-C20 heart cut is separated into various single carbon-cuts and blends for sale. The rest of the production is passed on to SHOP's second stage which converts it to C8-C18 linear internal olefins via isomerization, disproportionation and recycling. The SHOP process is characterized by low energy consumption and environmental impact, and flexibility to produce various chain length olefins and derivative alcohols.



Senior research technician Leana Terrill operates a video-goniometer used in dynamic detergent studies of the removal of microdroplets of soil from single fibers.

and from other processes if needed—are converted to detergent alcohols via the Shell Hydroformylation (SHF) process. In these units, olefins are reacted with synthesis gas, a mixture of carbon monoxide and hydrogen, to produce high normality detergent alcohols in the C9-C15 range. The first unit at Geismar was put on-stream in 1967, followed by two more in 1977. SHF plants also produce detergent range alcohols for associated Shell companies in the U.K. and Japan.

The essence of SHF is again a proprietary metal-ligand catalyst system. In addition to other process benefits, this one favors attachment of the alcohol group at the end of the olefin chain, resulting in high linearity, desirable for high detergency and rapid biodegradability. Lynn Slaugh, co-inventor of the catalyst system, is now a Distinguished Scientist in the Exploratory Chemistry Group at Westhollow—the only Shell Development scientist to hold that title. "This system had all the advantages you dream of, and at the time was at the forefront of science," Slaugh said. Today, Slaugh and other Westhollow chemists continue to seek those breakthrough inventions that make the difference. In addition to such exploratory efforts, Westhollow also carries out market-driven

process chemistry research, directly sponsored by the detergents business, to seek new routes or new chemicals.

The third key technology employed at Geismar is the Shell Ethylene Oxide Process which converts ethylene to EO via a direct oxidation route. The process was first operated by a licensee in 1958. Geismar's two plants were put on-stream in 1967 and 1979. About one-half of the world's EO is produced in Shell-designed plants. In addition, Shell produces the highly selective proprietary silver catalysts used in EO production. Research plays an important role here, too. The latest versions of these catalysts developed at Westhollow represent significant advances over those in use just a few years ago.

"While the original inventions for all three of the key processes employed at our Geismar plant were made before Westhollow was built, there is always room for improvement," according to Ed Heerdt, manager of the chemical development department. "We have a sizeable R&D program seeking and developing improvements to these processes. It's a competitive world out there and it's perilous to stand still and rest on your laurels. I am proud to say that Westhollow has contributed to substantial advances in all three processes in the past few years. Translation of research concepts to plant operations, however, takes a lot of team work with experts in our engineering and plant organizations."

The competitive environment

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also drives evergreen improvement efforts in the product performance arena. Jerry Moffett Jr., business manager for "Neodol" alcohols and derivatives, commented, "The consumer products being developed today are much more complex than those of just a few years ago. The needs of the formulators, our customers, are continually evolving, and so we must develop and renew our product line to remain competitive. We look to research to help us identify unmet needs in the marketplace and to develop product innovations to fill them."

Much of the applications research effort at Westhollow is oriented toward those consumer detergent markets, and is targeted heavily toward the needs of specific customers. "The consumer product companies are extremely sophisticated in the many ways they evaluate a detergent's performance," according to Ed Rosenquist, research manager for applications chemistry. "Our role is to complement their skills, to point out benefits they may not have seen, or to provide an independent validation of what their tests are showing. Of course, we do all the standard kinds of detergent evaluation with Terg-O-Tometers for laundry testing, and with foam tests for dishwashing, but we've also developed some pretty sophisticated techniques of our own."

Bill Shebs, senior research chemist in Shell Development's analytical department, for example, was one of the pioneers in developing radiolabeled sebum and clay soils for laundry testing. Lou Kravetz, a staff research chemist in the applications chemistry group, has used the method extensively. "This technique gives us information on the actual removal levels of the various components of laundry soils. It complements the bundle tests and other more practical methods of our customers and helps us develop insight into the fundamental aspects of detergency mechanisms. Even after 20 years, we continue to use and develop this powerful technique. Recently we've put emphasis on automating laboratory detergency tests using robotics. Al-



Video monitors provide close-ups for researchers to study soil removal from single strands of fibers.

though the primary driving force was improved manpower usage, it is interesting that automation has provided additional benefits and, in some cases, changed the way we design experiments. For example, we have been looking much more than we used to into the kinetics of detergency and into temperature as a variable. Robotic automation also provides greater flexibility and improved precision when examining this kind of parameter," Kravetz said.

Other sophisticated techniques used by the applications group include: a video-goniometer to study the dynamic removal of soil microdroplets from single fibers and fiber bundles, a dynamic interfacial tension apparatus, and a dipping probe turbidimeter for measuring phase changes in detergent solutions. "By using an array of such techniques, we are able to get a better handle on just how our surfactants behave at the fundamental level, both alone and in formulated products," Herb Benson, staff research chemist, said. "This has proven very beneficial on certain problems that customers have brought to us, and it strengthens our ability to evaluate our own new surfactant candidates."

"Another area where there is a strong external focus to our research is in the environmental area," Rosenquist said. Westhollow's environmental sciences department has an active research program studying surfactant behavior in various waste treatment processes, metabolite analysis and

aquatic toxicity effects. In addition, Lou Kravetz and Kathryn Guin, a research associate in Westhollow's analytical department, and other experts are active participants in environmental research programs sponsored by The Soap and Detergent Association.

Like other parts of Shell, Westhollow Research Center puts safety programs as high priority issues. It also has implemented a formal Quality Improvement Process. Although safety lends itself to measurement, quality improvement in a research environment is a more elusive concept to track. "We initially adopted a widely used quality improvement technique, and then modified it for our own situation. This has worked fine for repeated activities. We have institutionalized a common language related to quality improvement and have established a network of quality teams throughout the research center. I believe we are beginning to see savings and efficiencies as a result. However, we believe we can do more to improve our research effectiveness still further. Above all, we'd like to be working on the right things all the time," Glockner said.

Through a research cost-sharing agreement, Westhollow staff have access to R&D being carried out in other laboratories of the Royal Dutch/Shell Group. Regular dialogue occurs with scientists and engineers involved in detergent product and process R&D in Amsterdam, The Netherlands, and in environmental and human safety re-

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search in Sittingbourne, U.K.

Royal Dutch/Shell has been involved in the detergents business since 1942 when it brought the first petrochemicals plant in Europe on-stream, a small unit at Stanlow, U.K., that cracked wax to produce long chain olefins and converted them to surfactants by sulfation. The products were the first in the "Teepol" product line, which soon became a standard around the world, with the original plant running until 1975. Building on that early start, associated companies have used the SHOP and SHF technologies, pioneered in the U.S. by Shell Development Company and the Geismar plant, in plants operated in the U.K. and Japan.

Although consumer detergent practices in Europe and the Far East are somewhat different from those in the U.S., the differences are narrowing. There are many similarities in product and process technology. "We have extensive re-

search and technical interactions with our associates in Europe to our mutual benefit," Don Haupt said. "Like many businesses, the detergents business is becoming increasingly global and we must stay close to worldwide R&D trends to remain competitive long term."

S&D short course attracts 300

Approximately 300 persons were registered to participate in the AOCS/CSMA Surfactants and Detergents Industry Conference held at the Hotel Hershey in Hershey, Pennsylvania, Oct. 29-Nov. 1, 1989.

The conference was being held after the deadline for this issue; a report on the meeting will appear in the new AOCS news/membership magazine, *INFORM*, which debuts in January 1990.

Rhone-Poulenc in U.S. market

Rhone-Poulenc has announced it will buy RTZ Corp.'s specialties business for \$820 million and GAF Corp.'s surfactants and specialties unit for \$480 million, resulting in a sizeable U.S. presence for the French chemicals company.

The GAF operation will be Rhone-Poulenc's first endeavor in the U.S. surfactants area; it already has surfactants and phosphate operations in Europe. The transaction includes manufacturing facilities in Spartanburg, South Carolina, and production and research facilities in Winder, Georgia, and Mississauga, Ontario, Canada. The RTZ merger involves assets in Great Britain as well as in the United States.

In 1986, only 3% of Rhone-Poulenc's sales were in the U.S., a

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market which accounts for 40% of worldwide chemical consumption. Since 1986, Rhone-Poulenc has bought Union Carbide's agricultural unit and Stauffer's basic chemicals division. In total, the two latest mergers are expected to boost Rhone-Poulenc's U.S. sales by about 50% from their level a year ago, from \$1.4 billion to \$2 billion. The group's sales in the United Kingdom are expected to climb by 60% with the RTZ acquisition.

GAF acquired the Winder, Georgia, and Canadian facilities in 1987 when it purchased Alkaril Chemicals Ltd. Products from these facilities include phosphate esters, nonionics, amphoteric, imidazolines, quaternaries for fabric softeners, specialized agricultural surfactants, alkaline amides and sorbitan esters. GAF's Spartanburg division, meanwhile, manufactures cationic and nonionic surface-active agents for formulators of pulp and paper, metalworking, water treating, coatings, textile and cleaning products.

Rhone-Poulenc also will acquire capabilities to produce such other chemicals as specialty phosphates, dispersants, polyols, oilfield chemicals, silicone products and textile specialty chemicals.

DIC to reorganize U.S. Reichhold

Dainippon Ink and Chemicals (DIC) of Japan has announced plans to reorganize its subsidiary, U.S. Reichhold Chemicals, by concentrating main offices and three divisions at the Research Triangle Park in North Carolina. DIC intends to establish a general research laboratory incorporating the previous separate labs for polyester, paint and emulsions.

Shiseido retains cosmetic lead

Shiseido has retained the largest market share in the Japanese consumer cosmetic market, but its mar-

ket share has slipped slightly since 1986.

Shiseido's 1988 estimated market share was 25.9% compared to 27.6% in 1986; Kenebo's 1988 market share was estimated at 13.7%, up from 13.1% in 1986; and Kao's 1988 share was about 4.4% compared to 2.3% in 1986. The Japanese retail market puts heavier emphasis on brand name chain stores rather than sales through department stores or supermarkets.

Shiseido to fund U.S. research

Shiseido of Japan has agreed to provide \$85 million over 10 years to establish and support what is described as the world's first comprehensive dermatology research center at Massachusetts General Hospital-Harvard Cutaneous Biology Research Center (CBRC).

The center not only researches remedies for specific diseases, but also conducts basic research in such fields as the dermal aging process.

PPG acquires Clorox units

PPG Industries Inc. of Pittsburgh has agreed to buy Clorox Co.'s two paint subsidiaries for \$130 million.

The units are Olympic Home-Care Products and Lucite Home-Care Products, which have combined annual paint and stain sales totaling more than \$100 million.

PPG's acquisition under the transaction, subject to clearance by government approval and other conditions, includes plants in Ballard, Washington; Batavia, Illinois; Langley, British Columbia, Canada; and Louisville, Kentucky; and headquarters' offices in Bellevue, Washington. The Olympic and Lucite units employ about 350 persons.

Clorox officials said the company decided to sell the paint and stain businesses so that it could focus on its household and grocery-products operations. *(Continued)*

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LAB venture in Thailand

Companies in Japan's Mitsubishi Group will join U.S., Dutch and Thai interests in a joint venture in Thailand to produce linear alkylbenzene (LAB) for detergents.

Mitsubishi Corp., a giant Japanese trading house, will own 27% of the venture—Thai Alkylate Co. Other partners will be Mitsubishi Petrochemical Co. (5% share); Lion Corp. of Japan (16% share); Colgate-Palmolive (Thailand) Ltd., a subsidiary of Colgate-Palmolive Co. of the U.S. (16% share); Lever Brothers (Thailand) Ltd., a Unilever subsidiary (16%); and Kiarti Group, a Thai financial concern (20%).

Construction of the LAB plant, with capacity to produce 40,000 tons a year, is to begin in May 1990, with completion set for mid-1992. The plant is to be in Rayong, about 100 miles south of Bangkok.

Surfactant plant set

Albright & Wilson Ltd. has signed a cooperation agreement with BP Chemicals under which Albright & Wilson will manufacture ethoxylate surfactants at BP Chemicals' Lavera Petrochemical Complex in France.

The facility, slated to be on-stream early in 1991, will be constructed by Albright & Wilson. Under the agreement, the ethylene oxide feedstock will be delivered by pipeline from the BP Lavera ethylene production unit within the complex.

P&G to buy Noxell Corp.

Procter & Gamble Co. (P&G) has agreed to buy Noxell Corp. in a stock swap valued at approximately \$1.3 billion.

Noxell, based in Hunt Valley, Maryland, has been controlled by

descendants of its founder, George Avery Bunting, who developed Noxema skin cream in 1917. The company also makes Cover Girl makeup, the Clarion line of cosmetics, Lestoil cleaner and a seasoning for chili. Noxell company officials said the company decided to sell out to P&G because it needed outside money to improve its research and development and to expand internationally.

Completion of the transaction was expected by the end of 1989. It represents one of P&G's largest purchases and illustrates P&G's increasing emphasis on buying brands to complement its in-house research.

Witco buying tallow unit

Witco Corp. is purchasing Union Camp Corp.'s tallow fatty acid business.

Included in the purchase are formulations and manufacturing technology related to the Union Camp tallow fatty acids business. Witco currently produces the same class of products.

As a result of the acquisition, Witco will manufacture the fatty acids at its Humko Chemical Division's plants in Newark, New Jersey, and Memphis, Tennessee. Earlier this year, the company had announced a \$6.5 million expansion in Memphis; the newly acquired tallow fatty acid business will help absorb some of the new capacity. That project is expected to be completed in the latter part of 1990.

New plant announced

Givaudan is planning to invest \$35 million in a U.S.-based plant to make Lilial, a basic aroma chemical.

The site of the plant should be determined by the end of the year. Lilial is a basic aroma chemical used in soaps and detergents. Givaudan currently manufactures the chemi-

cal in three locations: Vernier-Geneva, Switzerland, Clifton, New Jersey, and San Celonia, Spain. Once construction has begun, the plant should be operational within three years, and will significantly reduce the environmental impact in comparison with present manufacturing processes, according to a company spokesperson.

Report uses new terms

A report published by Hewin International Inc. of The Netherlands classifies surfactants into "nitrogen-bearing" and "non-nitrogen-bearing."

The report, entitled "Nitrogen-bearing Surfactants in Western Europe, North America and Japan," said that surface-active materials in this category include cationic and amphoteric compounds, alkanolamides, sarcosinates, taurates, sulphosuccinamates, amides, phosphatides and protein-based materials. The most important, it said, are the cationic, amphoteric and alkanolamide surfactants, representing three types of ionization behavior.

Included details show 1988 consumption of primary amines totaled 34,000 metric tons (MT) in the U.S. and 24,000 MT in Western Europe. Consumption totals of other amines were the following: secondary amines, 20,000 MT (U.S.) and 15,000 MT (Western Europe); tertiary amines, 97,000 MT (U.S.); and 85,000 MT (Western Europe); and amido amines, 48,500 MT (U.S.) and 28,500 MT (Western Europe).

For more information on the report, contact Hewin International Inc., Van Leyenberghlaan 159, PO Box 7813, 1008 AA Amsterdam, The Netherlands.

News briefs

Unichema Chemicals Inc. is implementing Statistical Process Control (SPC) as part of its efforts to further improve quality assurance and quality control programs.

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The Soap and Detergent Association has won a red, white and blue C-flag—a symbol from the American Society of Association Executives recognizing outstanding contributions to the American spirit of volunteerism and community action—for its "Home Safe Home" program which focuses on helping to reduce accidents involving young

children. The award is administered by the American Society of Association Executives.

Rohm and Haas and Orken are forming a joint venture to manufacture and sell polyacrylate water-soluble polymers. The new company, Norsohaas, will be located in Villers-Saint-Paul, France. Ca-

capacity for the new facility will be 40,000 metric tons.

Henkel Corp. is establishing the Henkel Corporation Research Fellowship for students working toward a doctorate in surface or colloid chemistry. The fellowship will provide \$20,000 per year during the students' third and fourth years of doctoral study. It will be administered by the American Chemical Society's Division of Colloid and Surface Chemistry and will first be offered in the fall of 1990. For further information, contact Bill Kosman, Henkel Corp., by calling (215) 270-8196.

A second person has died in connection with an explosion and fire that occurred at a Quantum Chemical Corp. ethylene plant in Morris, Illinois, during September 1989. Company officials said the ethylene plant will not resume operations until early in 1990.

Adolf L. de Jong, who co-chaired the Second World Conference on Detergents held October 1986 in Montreux, Switzerland, has retired from Unilever N.V.

J.W. Collins, president and chief operating officer of Clorox Co. for the past 13 years, will retire Dec. 31, 1989. In anticipation of his retirement, the company has made the following appointments: G. Craig Sullivan, to group vice president with overall responsibility for U.S. household products and international business; W.E. Lynn, to group vice president with responsibility for human resources, business development and new business projects; Donald C. Murray, to vice president of household products; and Robert J. Diaz, vice president for international business.

Union Camp Corp. has completed an expansion and modernization of its dimer and polyamide facilities at its Dover, Ohio, plant. The plant, acquired by the company in 1970, converts tall oil, other fatty acids, castor oil and other raw materials into dimer fatty acids, numerous fatty acid derivatives, sebacic acids and polyamides.

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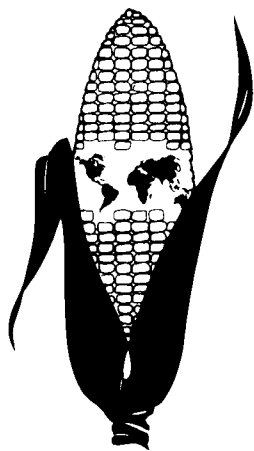
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