

Oil Mill Gazetteer

Shear Madness

For Walter Farr, a 20-year quest to bring physical refining to the vegetable-oil extraction process reached a turning point when he found a mixer that took high-shear to a new level.

A chemist by training and chemical engineer in practice, Farr served as an expert in fats and oils with Kraft Foods until four years ago, when he joined De Smet Process & Technology Inc., Marietta, Georgia. Earlier, he began experimenting with alternatives to chemical processing of soybean oil, conducting bench-top experiments that applied high-shear instead of acids and caustics as part of the extraction process.

Commercial applications began in Europe and South America a quarter-century ago, but the results were less than satisfactory. Those plants had to revert to hybrid systems relying on costly processing aids that compromised oil quality.

"The only bench-top high-shear mixer available at the time was a heavy-duty Waring blender," Farr says of his early experiments. "I used it for years and was getting very good results, provided the crude oil going in was very good quality." Unfortunately, poor crops are as inevitable as good ones, and Farr tried a number of high-shear units before applying what he describes as an ultra-shear mixer: a machine capable of applying 100,000 reciprocal seconds of shear force.

"When I began using a three-stage rotor-stator assembly from IKA Works, I started to get dramatically better results, but this was bench-top, not commercial scale," he recalls. He worked with Michael Janssen and engineers at IKA's Wilmington, North Carolina, shop to devise a process using a pre-stage mixer as an alternative to acids to hydrate phosphatides in the bean, then a second mixer instead of caustic to remove free fatty acids before the oil enters the deodorizer, where vacuum steam distillation is applied to remove volatile compounds. If bean quality is low, some caustic may be necessary upstream of the deodorizer, resulting in "semi-physical refining," Farr explains. Still, chemical

Farr Forms Mixing Company

Walter Farr, president, the Farr Group of Companies, Olive Branch Mississippi, has announced the formation of another company, the Farr Mixing Company. Initially, the sole product will be retention (residence) mixers used in the low-temperature/long-mix process of caustic refining of vegetable oils. Farr says this mixer is a radically different design from the disc and donut type retention mixer that has been the standard for the low-temperature/long-mix process in the United States for over 50 years.

"This new design provides retention time to allow the chemical reaction to proceed to completion, while providing the perfect mixing conditions to ensure the optimum separation of the reacted components downstream," Farr said. While this new mixer will improve the efficiency and oil yield in conventional caustic refining, it is mandatory for use in the Walter



Belt driven Dispax Reactor (175 gpm).

The heart of the high shear mixer. "Generator" is an IKA term, or also called "set of rotor/stator." Precise machining with tolerances of 1/1000 of a millimeter (1 micron). The radial gap (gap between rotor and stator) is between 0.2 mm (small machines) and 0.5 mm (larger machines).

use is significantly reduced, and the process results in "dramatically improved yields," he says. "It's difficult to define, but in a large refinery, even a one percent yield improvement can be worth millions of dollars a year."

Though he retired from De Smet and established his own consultancy in Olive Branch, Mississippi, a year ago, Farr continues working closely with the firm and IKA to implement his process. An Illinois-based edible oils facility deployed the process four years ago, and Mexico's first greenfield plants in 30 years are "operating very well" with the system, he says. A processing facility being built in Alexandria, Egypt, also will utilize physical extraction, and he anticipates retrofitting existing plants.

Optimizing the system is how Farr and other specialists make their livings, but essentially the trade-off is high-shear for chemicals. "It's impossible to get too much shear," says Farr.

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Farr Ultra-shear Mixing process for caustic dispersion. With Ultra-shear mixing technology, if any retention time downstream at all is used, it must be very gentle to prevent some of the reacted components from going back into solution.

The mixers will be available in three sizes, FM 160, FM 320, and FM 500, and a mixer or combination of two mixers, will cover every refinery capacity from 15,000 lb/hr to 120,000 lb/hr. All the mixers will be 7 feet tall, only the diameter changes to increase retention time for a particular flow rate. Patent is pending. Farr says that the new retention mixer is in the final stage of design, and pilot plant testing will begin soon. A unit will be in a Beta Test Site by July, 2005. Mass production will be expected by the end of the year. Farr also notes that there may be many other applications for this design, such as crystallization, but that research will be held until the refining application is well proven.