are expensive and labor-intensive steps. Ultrafiltration offers a simpler, faster method, Sellick says.

So far, Pall has developed some cassette holders for semidisposable ultrafiltration membranes, which it also is selling in India and China. The company also is tailoring its vibrating PallSep membrane to process the plant and animal sources used to manufacture some "transgenic" protein drugs. PallSep (Photo, p.12) is composed of a sealed stack of flat, circular membrane plates connected by a torsion bar to a seismic mass. A motor applies a controlled torque to the mass so that the membrane stack oscillates at about 60 Hz. This oscillation helps prevent fouling, Sellick says, since transgenic sources typically contain a high percentage of solids. In competing filtration separation processes, fluid is typically pumped at higher velocities or pressures to prevent fouling.

For a typical 400 ft^2 installation, Sellick says, PallSep could allow users to save some 30 to 40 percent in capital costs. These costs would include the $30,000 needed for the pumping system, the complex valving that, in some cases, may cost up to $175,000, and costs for the energy required, some 75 Kwh compared with PallSep's 4 Kwh.

Pall is developing a fully enclosed PallSep unit to bring a barrier process to first-stage clarification and recovery, Sellick says, making it easier to meet both FDA and USDA regulations. An unexpected result of the contained process for some manufacturers has been eliminating the workplace odors inherent with some tissue-extraction processes. A disposable cartridge is also being developed for smaller scale units.

Several European biotech companies are currently licensing PallSep for transgenic protein drug manufacturing. One biopharmaceutical company has standardized on PallSep for a new generation of recombinant vaccines, and reportedly has filed for an application patent for using the technology.

Imaging Helps Treat Chemical Processing "Patients"

Just as doctors prescribe CT scans for their patients, a growing number of chemical processing companies, including DuPont, Huntsman, GlaxoSmithKline, Syngenta and Imerys– not to mention the equipment firms Pfaudler-Balfour and Rosenmund – are turning to industrial process tomography to help optimize their mixing, separation and reactor systems. Within the past few years, projects funded by a number of chemical company partners

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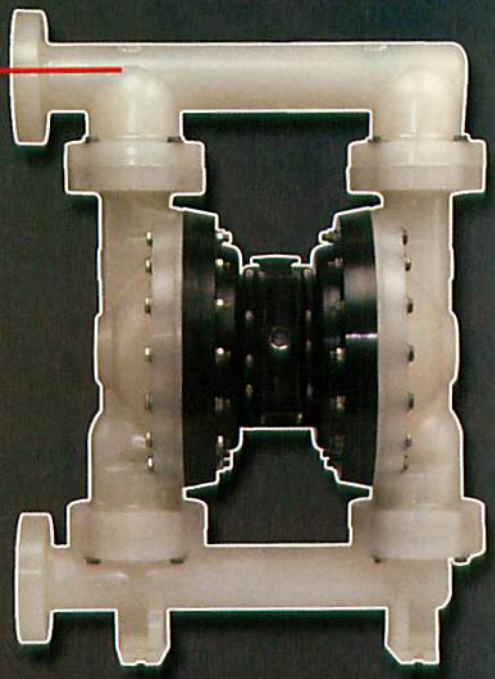

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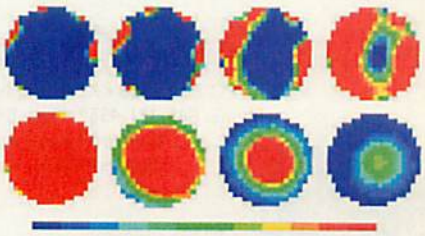
have applied the technology to monitor hydrocyclone separations, industrial pressure filters and batch and continuous mixing.

Pressure filtration trials at Syngenta

At the third World Congress on Industrial Process Tomography, held in Banff, British Columbia, last month, some of these new applications were discussed, including validating computational fluid dynamic (CFD) simulation data. The catalyst company Synetix (www.synetix.com), which was bought by Johnson Matthey Catalysts earlier this year, recently applied electrical resistance tomography to validate CFD simulation for a new fixed-bed reactor design. Supplying the imaging equipment and know-how was Industrial Tomography Systems (ITS; www.itoms.com), a company spun off by the University of Manchester's Institute of Science and Technology, U.K. Synetix says the technique offers a cost-effective alternative for validating CFD models.

In this project, 16 electrodes were arranged symmetrically in a plane around the circumference of a Synetix model reactor so that they contacted the process fluid but didn't disturb the flow. Current applied in a very fast predetermined sequence between the electrodes provided imaging data which, fed through a specially-written algorithm, gave a real-time picture of flow in that plane. Using electrodes in eight planes gave a view of the whole reactor.

Another Banff presentation described electrical tomography applied to pressure filtration. Pressure filters generally have no instrumentation to indicate an end point, and difficult separations can take days to "complete". Tomography shows when a cake is dry.



Flow patterns in the Synetix model reactor revealed by tomography: (reading top row left to right and bottom row right to left) against a background of water flow (blue) a pulse of sodium chloride solution (red) passes radially across a single plane of the reactor

Filter manufacturer Rosenmund and manufacturer Syngenta have been trying it out in trials supported by the U.K. government. In this case, the 16 electrodes are placed on a mesh across the

filter cloth. The resulting image shows where the filter cake is uneven and when an end point has been reached. The technology is equally useful when the cake is being washed, rinsed and dried.

Tomoflow, of Dorset, U.K. (www. tomoflow.com), is a new company working with capacitance-based tomography, and recently commercialized the Tomoflow multiphase flow analysis system for imaging, flow velocity, flowrate and volume measurements in fluid-fluid and fluid-solid mixtures.

Molecular Modeling, Up Close

The National Institute of Standards and Technology (NIST) is using the ITL Immersive Visualization Laboratory (Photo), a three-dimensional facility at its Gaithersburg, Md. headquarters, to scale up molecules, creating three-dimensional models that move. Using software developed at the Institute, and a reconfigurable automatic virtual environment (RAVE) developed by Fakespace Systems Ltd. (www.fakespace.com) in Marshalltown, Iowa, including eyewear and large display screens, the new laboratory aims to help users understand the mechanics behind molecular interactions much faster than

NIST researcher Carlos Gonzales led a research team using a 3-D virtual reality molecular modeling laboratory to study the molecular bonding of shake gels.

Source: NIST

traditional desktop computer-modeling methods can.

Scientists and industrial collaborators at NIST have recently used the facility to study "smart gels," which grow or shrink in response to outside stimuli. Their research, sponsored by Kraft Foods and involving scientists from Los Alamos National Laboratories and Harvard University, focused on "shake gels," a type of smart gel composed of clay and polymer mixture, that gels when shaken, then liquefies when at rest.

The visualization lab made it clear that the polymer's oxygen atoms attach to the clay. Scientists had previously thought its hydrogen atoms were the links between the two components.

Supersonic Shockwaves Drive New Fluid-Processing System

Pursuit Dynamics PLC, Royston, U.K. (www.pursuitdynamics.com), has started commercializing PDX, a new fluid processing system that integrates pumping, mixing and heating functions in a single unit without moving parts. Driving the system is a patented