

SAY GOOD-BYE TO OLD-SCHOOL CENTRIFUGES

More modern equipment provides increased efficiency, flexibility and safety

Many chemical processes in the U.S. that use centrifuges were established between the 1950s and the 1980s. As a result, most of these machines employ technology that was outdated literally generations ago. In addition, many processes have changed since installation, and doing more with less is now a key method of survival in today's global economy. At the same time, regulatory and environmental issues have become more important. This combination of outdated equipment, the advent of more modern processes, a tighter economy and bumped up compliance creates challenges for chemical processors using old-school centrifuges. Fortunately, more modern equipment is available to bring these processes into the 21st century.

"Processors are working to optimize product throughput, product yields and separation efficiency while keeping an eye on energy costs," says Chad Mendelsohn, sales manager of chemical centrifuges with TEMA Systems (Cincinnati, Ohio). "In our applications, the largest energy costs are often in the downstream-process thermal dryers — where for every 1% of extra moisture removal through mechanical separation of a solid, a dramatic longterm savings is produced. Lower discharge moistures can also increase the potential throughput of a whole process line."

Mendelsohn adds that as plants try to keep up with demand for their products with less and less staff available, processors look to maximize production up time while limiting operator interface requirements and the need for maintenance. Certain applications also have environmental reasons to

minimize personnel interaction with the process equipment.

All these challenges lead to one thing: The need for modern equipment that is highly efficient and flexible, as well as safer and more automated.

Higher efficiencies

Chemical processors are looking for higher recoveries and higher captures from their centrifuges, says Victor Norton, vice president of sales with Andritz Separation (Arlington, Tex.). In addition, they want dryer cake discharges and less moisture so downstream drying costs are reduced, he says. This demands more efficiency and effectiveness out of the machines.

One of the ways this is accomplished, says Norton, is by improving the internals of the centrifuge. A typical decanter centrifuge has a bowl and scroll or conveyor within the bowl to move the settled solids. There are different pitches on the blades of the conveyor and differing numbers of leads (usually single, double, triple or more). "The variations here have the ability to provide a dryer cake discharge and more capacity, and we are improving the internals all the time," says Norton. "Years ago a 40-in.-dia. machine on a PVC line would process 7 ton/h. Now the same size machine can



FIGURE 1. Thickened sludge is discharged efficiently with the THK Series's Hydraulic Assist Technology, so the process of centrifugal thickening offers a low-cost and smaller footprint approach to reduce volume while increasing digesting capacity and performance

Heinkel USA

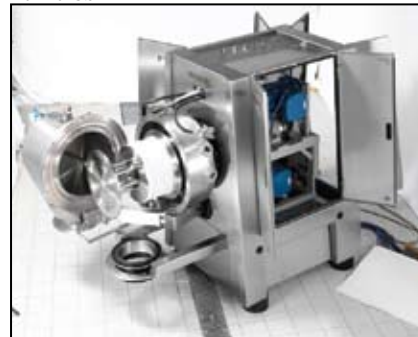


FIGURE 2. The inverting filter centrifuge technology allows difficult-to-filter material that traditionally could not be processed on a centrifuge to be turned into a dry powder

handle up to 15 or 20 ton/h due to the speed of the machine and new designs on the pitch of conveyors."

He adds that materials of construction for the bowl and type of drive used also increase the speed of the machine. Stainless steel was previously the typical material of choice, but now heavier strength alloys like duplex steel are needed for corrosion resistance and strength. New controls, too, such as variable frequency drives (VFDs), which allow soft starts that don't consume as much horsepower as an across-the-line start and move things along at a faster, more consistent rate, are also being employed. "Scroll drives can be VFD, which

influences the performance of the machine to get dryer cakes out of some applications and it often leads to a more uniform process,” says Norton. “Without good control, the early feed off the tank is usually consistent, but once the bottom of the tank is reached, there is usually a thinner slurry coming into the centrifuge. Better controls provide more uniform feed, which leads to more uniform centrifuge performance.”

Michael Kopper, CEO at Centrisys (Kenosha, Wis.), agrees that these improvements lead to more efficient machines. “The improvement of materials of construction (away from stainless toward duplex) along with the ability to increase the speed of the machine and overcome the performance-handicaps processors have been dealing with go a long way towards helping processors overcome their separation challenges.”

Kopper says many of his company’s machines include a newly designed back drive system, which conveys the scroll inside and allows the centrifuge to run at higher torques. “Higher torques help increase the loading of the machines,” he says. “And often when you put more load in, you get a drier product out.”

Centrisys’s THK Series of thickening centrifuges embraces this type of improvement in some applications like sludge thickening, which uses centrifugal force to increase the concentration of waste-activated sludge for further processing. During operation, sludge is continuously fed into the unit. The moving shaft has a set of helical scrolls, which push the solid waste toward one end, away from the liquid moving in the opposite direction. “The thickened sludge is discharged more efficiently with the THK’s Hydraulic Assist Technology (Figure 1), so the process of centrifugal thickening offers a low-cost and smaller footprint approach to reduce volume while increasing digesting capacity and performance,” explains Kopper.

Greater flexibility

“It is true that the need for shorter cycle times, reduced downtime and drier cakes has become the new mantra among chemical processors,” says Tom



TEMA Systems.

FIGURE 3. The design of the Turbo Screen Decanter combines the advantages of the solid bowl centrifuge and the screen centrifuge into two distinct stages

Patnaik, director of sales and marketing with Heinkel USA (Swedesboro, N.J.). “In addition to that, the need to perform more than one action within the same space has led to the need for centrifuges with multi-functional traits and more flexibility.”

He says the Heinkel inverting filter centrifuge (Figure 2) can help here. “Modern innovations have allowed the equipment to extend the traditional dewatering role of the centrifuge into the realm of separation and drying with the incorporation of PAC (pressure added centrifugation),” says Patnaik. This feature, which utilizes high-pressure air or nitrogen, either at ambient or elevated temperatures, further reduces cake moisture. “In some applications it makes using a downstream dryer unnecessary.”

The unit is able to handle a variety of materials that traditionally could not be processed using a centrifuge and can optimize a process using Heinkel’s thin-cake filtration along with the PAC system to turn difficult-to-filter materials into dry powders.

Derek Ettie, managing director of the process division, with GEA Westfalia Separator (Northvale, N.J.), also cites “multi-use equipment” as a great need in the chemical process industries (CPI). “We used to sell a machine for one process or product and now our customers are looking for a machine that they can use on many products,” he says. “We are also seeing existing customers that already have our equipment, asking us to modify it so it can be used in different ways.”

One of the biggest game changers, he says, is the use of new materials of construction, such as special duplex stainless steel or Hastelloy. “When you are running a variety of materials through the same piece of equipment, you have to make sure it won’t corrode, erode, dissolve or be susceptible in any way to chlorides, high temperatures or low pH,” explains Ettie. “Because with different processes, there will be dif-

ferent process variables, chemicals or cleaning solutions being introduced frequently. The equipment needs to stand up to this sort of abuse.”

“Another way to provide flexibility, embraced by TEMA, is through customized equipment. Hybrid machines, like decanting centrifuges with internal screening sections have become more common in spite of the fact that they are more expensive upfront,” says Mendelsohn. “We find ourselves supplying more machines with built-in flexibility as end users seek to protect themselves from potential process changes,” he says. “Having a more flexible piece of equipment can often take a process that has normal process variation and dampen the variability of the end product.”

One such hybrid is the Turbo Screen Decanter (Figure 3). With usual screen-bowl centrifuges, the screen section connects to the drum cone at the point of its smallest diameter with identical dimensions. This design often restricts volume and creates a higher solids layer, with reduced centrifugal forces in the dewatering section of the centrifuge. To combat this issue and boost flexibility, TEMA’s Turbo Screen combines the advantages of the solid bowl and the screen centrifuge into two distinct stages. This permits clarifying and drying in two separately designed stages, eliminates compromise between clarifying and drying sections, and allows pre-thickening of the solid material and optimum removal of residual moisture from the pre-thickened solids cake in the large-volume screen drum due to higher centrifugal force. Higher yields with minimum loss of solids and recirculation of the separated liquid are added benefits.

Increased safety

The CPI are characterized by extreme processing conditions and challenging substances, such as concentrated acids and explosive materials. No-



FIGURE 4. Gas-tight decanters are designed for applications where excess pressure and temperatures are a safety consideration

where does safety hold such a high priority. For this reason the development of safer equipment is just as important, if not more so, than developing more efficient, flexible equipment. One of the most important safety boosts to come along has been the advent of gas-tight units.

“Where people are using solvents for extractions and separation of flammable materials it is essential to have a gas-tight unit or a nitrogen blanket to avoid explosions,” says GEA’s Ettie. “Customers rely on us to supply solutions that ensure the purge gas is delivered to the centrifuge properly, so we offer a gas-tight decanter (Figure 4) and gas-tight disk-type centrifuge.”

The line of gas-tight decanters is built in accordance with European ATEX regulations and is designed for situations with excess pressure and temperatures. Electrical components are designed for operation in explosion-protected zones.

Even when the material is not explosive, it can still be hazardous, adds Greg Cybulski, vice president of sales and marketing with Celeros Separations (Foxboro, Mass.), which makes separation equipment for the biotech and biochemistry industry. “Many of the applications we deal with include a hazardous or biological agent that requires a certain set of standards and qualifications of personnel,” he says. “Our customers need equipment that manages the safety and hazards

surrounding the material they are processing, and that almost always requires a closed and sealed process.”

To that end, Celeros introduced the APD (Automatic Piston Discharge) Centrifuge. Cybulski says the centrifuge allows end users to maintain an isolated environment, which is an important safety consideration compared

to traditional bioprocess centrifuges where the recovery of clarified liquid and concentrated paste was a manual effort. “The APD technology allows the process of paste recovery to be automated so that there’s no requirement for an operator to get involved,” he says. “The entire process can be done in a completely enclosed manner and

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deliver paste in a form that's very easy for downstream handling."

Similarly, in the biopharma industry, there's been a trend toward smaller, more flexible batches, requiring greater containment and less handling. "Equipment has responded to this market force and, one of the best examples of that is the pressure

Nutsche filter-dryer," says Patnaik.

In many applications, the Nutsche overlaps a centrifuge and dryer combination effectively. The Nutsche can accept a slurry and put out a dry powder, all without any material handling. Sometimes the Nutsche is combined with an isolation or glove box so that the product being discharged goes di-



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rectly into containers without any operator exposure.

"Its ability to work in a fully contained manner, in conjunction with an active isolation glove box, under slightly negative pressure has tremendous safety advantages and many customers with highly potent, active-pharmaceutical-ingredients applications prefer this equipment over other filtering or dewatering equipment," says Patnaik.

More automation

In addition to allowing hands-free centrifugal operations, automation is also helping make operations safer and more efficient. The introduction of plant-wide Ethernets and distributed control systems has spawned a new generation of smart devices for the measurement of pressure, temperature and flow control in the CPI. The control system may communicate directly with these smart devices or via an intermediate Scada system. In addition to providing realtime optimization, realtime asset management and alarm control, it also provides remote realtime information on a range of process parameters, troubleshooting and diagnostics.

"When the equipment is automated and it can measure variables such as vibration and temperature, it ensures both uptime and safety," says Ettie.

And the addition of remote monitoring capabilities only increases these benefits. "The increased complexity of PLC systems and drives allows an unparalleled amount of automation capability, as well as the ability to remotely monitor the centrifuge," explains Cybulski. "This level of automation enables us or end users to look at the operation of the machine, wherever it may be, and see when certain things like vibration or bearing temperature are going off spec. It enables action to be taken before something happens that would stop the process or cause an unsafe condition." ■

Joy LePree