

Separation procedures
Special section

Loosening up

Safe centrifugation and drying with broad grain size spectrum

Solid-liquid separation with the help of centrifuge dryers is common practice. With certain product features such as a broad grain size spectrum with a high proportion of fine grains, conventional centrifugation systems fail. Through a new production process, these problems can be avoided safely and reliably.

The known production sequences in a centrifuge dryer begin with the filling of the suspension into the filter drum. In the centrifugal field, the solid is retained in the multi-layer filter tissue and the mother liquor is filtered through the product cake. The filter cake is then washed. After washing, the centrifugation for the mechanical dehumidification begins. The remaining capillary height can be reduced by pressure overlap. In the next process step, the extremely efficient and gentle thermic drying begins in the form of packed bed drying and/or fluidised bed drying. After the product cake has been dislodged – the loose debris is located in the process chamber -, with fluidised bed drying either a stop-and-go or a continuous drying process is used.

With the stop-and-go procedure, the drum is positioned, a drying nozzle is moved against the stationary drum and the drying gas injected into the segmented work chamber through the openings in the drum base. The shot nozzles return to their original position and the drum is then turned further by the angle set until the next opening and until the next 'shot' of drying gas is carried out. The product is mixed and evenly dried through the successive rotation of the drum.

With continuous drying, the shot nozzles remain with a minimal gap in front of the drum base. The drum rotates permanently at a slow speed. Every time one of the openings in the drum base is located in front of the shot nozzle, drying gas is injected into the drum. Through the continuous rotation of the drum, the drum contents are continually mixed up and dried in a very homogenous, efficient and gentle manner. With packed bed drying, the product cake is initially not dislodged. The drying gas is blown into the process chamber, the product cake is passed through in an outwards direction and the moisture drawn out. The product is dried in its ring form and only subsequently dislodged from the filter drum. Materials that tend to clump are thus dried safely and without clumping.

Products with a fine grain

Products with a broad grain size spectrum and a high proportion of fine grains, with bimodal distribution cannot be centrifugated and dried with this procedure, or only with considerable effort.

During the formation of the filter cake, the fine product parts clog in the gaps between the larger parts; the liquid phase has trouble in draining off. This leads to the filtrate draining off very slowly through the product cake. The liquid ring becomes higher and higher and also breaks down extremely slowly. Furthermore, an undesirable sedimentation results from the long liquid ring.

Due to the different ratios between mass and surface, the large product parts settle in the centrifugal field more quickly on the outer edge of the filter cake in contrast to the finer parts. The finer parts float longer in the liquid ring, are deposited in the end on the cake ring and form an impermeable film of grease.

During washing and centrifugation, the filtrate speed is also very low and the process time is extended considerably. An increase in the rotation speed, i.e. an increase in the C value and/or overlying pressure does not lead to any better results in the overall process as the product cake is highly condensed and even less permeable for the drying gas during the continuation of the packed bed drying.

Loosening the product cake

This is where the new filtration and dehumidification process developed by Fima Maschinenbau comes into play. The counter impulse procedure can loosen up the product cake in every process step. During filling and washing, the C value is kept very low; a liquid ring is no longer formed, sedimentation and the formation of a film of grease are excluded. With the counter impulse procedure, the product cake is also not dislodged. The shot nozzles inject into offset openings in the base of the drum every time the drum is rotated. The gas flows through the moist product ring in the opposite direction to the centrifugal forces in an inward direction. As this is done at higher speeds, the product ring is kept upright by the centrifugal forces in the filter drum. This ensures that the material is loosened across the entire circumference of the drum, that its porosity is increased and that processing is facilitated again. In contrast to the previous processes, the drying gas also flows through the product cake twice, first when it is injected into the drum in an inwards direction. As the gas has to escape from the filter drum again, it flows through the filter cake a second time; the transfer of moisture to the drying gas is used more efficiently. To shorten the drying process, drying gas can also be blown into the filter drum via the fill shaft. In contrast to conventional packed bed drying, the gas flows through the product more efficiently due to the higher porosity of the filter cake. Another aspect is that no drying cracks can form as a result of the permanent loosening of the product cake. This means that the additional gas cannot escape from the filter drum without being used. As the filter drum remains stationary, the products in the filter drum cannot roll away as is the case with stop-and-go or continuous drying. Materials with a tendency to agglomerate remain homogenous and powderlike.

Can be removed without leaving any residual layer

The dried product is then removed. For this, the filter basket within the system, that remains closed, is opened at the front side and the powder is transported to the disposal chute solely by the rotation of the conical filter drum. As an option, equipment for gravimetric removal and/or pneumatic or vacuum transport is connected to the disposal chute. The product that remains in the filter is blown out through the shot nozzles. As the interior chamber of the centrifuge has been kept free of any fittings, the system can be emptied without encrustations and free of any residual layers. It is then available immediately for the next load.

This counter impulse procedure is also available as an update for existing systems. The TZZ centrifuge dryers can also be equipped with CIP, SIP, PAT modules and an online sample extraction. The centrifuge dryer is thus also specially suited for toxic products in high-containment systems. The hygienic design of the TZZ complies with

GMP and prevents any cross-contamination; all sealing systems are compliant with FDA. Depending on the application, systems are available for technical schools and production. The fill volume ranges from 37 to 800 litres of suspension, which corresponds to a cake volume of between 20 and 400 litres.

Bildunterschriften:

Opened centrifuge dryer with filter drum (left) and PAT system (right)

Continuous fluidised bed drying (left) and counter impulse procedure (right)

Big plans for the future

cav: How did Heinkel manage to strengthen its market position after the new start on 15th May 2005?

Rojan: We are satisfied with business development. Our goal was to consolidate the trust of our customers, to preserve continuity, to continue to guarantee a high quality of the systems and to build on the good tradition of the Heinkel name. Furthermore, we wanted to make the company more competitive. An important objective was also to expand our range of products and thus open up new markets. We managed to do so, among others, with the acquisition of GFT Trenntechnik Werner Putz GmbH. We then took over all the Heinkel foreign subsidiaries to strengthen our global sales and service activities further.

cav: How did the Heinkel corporate group come about and what role do the individual companies have?

Rojan: That's very simple. GFT, FIMA Maschinenbau – our parent company in Obersontheim – and Bolz-Summix have the same owners: Schaeff Beteiligungen & Management and Stibbe Management bv. Both companies are striving for a long-term commitment in the industry. This has thus given rise to a corporate group of legally independent companies, the products of which superbly complement each other. We work closely together in research and development, purchasing, sales and in service. Each of the four brands is a specialist in its area. Heinkel has been producing inverting filter centrifuges for more than 30 years and has a global share on this market of 90%. GFT's range includes peeler centrifuges for laboratories and production companies in the pharmaceuticals sector. In addition, other types of centrifuge from GFT are used in flue gas desulphurisation systems for plaster drying and for the classification of solids. The centrifuge dryers of FIMA combine separation and drying in a closed system. Conical dryers and mixers from Bolz-Summix round off the product portfolio of the corporate group. The four companies have equal rights within the group. There are currently no plans for a merger of the companies under corporate law or to reduce the number of brands.

cav: What are the benefits for the user?

Rojan: We offer complete system solutions and services from one source. In the process, we are not restricted to one system but can recommend to customers the system from our programme that fits their products. Combinations of different technologies are also possible here. From experimentation and planning, construction and building, to assembly on site and service, customers worldwide will receive everything from one source.

cav: Will the corporate group grow more closely together and will there be joint product developments?

Rojan: Of course that was a consideration when establishing the corporate group. We firstly intend to push developments in the area of peripheral systems. Automation, control technology and the safety concept of the individual systems should be standardised. One goal in this is the energy-saving and environmentally friendly alignment of the devices. For instance, we are currently working on a new system for the gas cycle with centrifuge dryers and inverting filter centrifuges and on new control concepts. Finally, we will adjust documentation, for instance, for the validation of the individual systems. Our aim is that the companies should work more closely together and that we can make use of even more synergies. For this purpose, we are in the process of building a new plant in Biesigheim; it is intended to be the most modern of its kind. We plan to further optimise and streamline the processes; finally, our competitiveness is to be improved further.

cav: What is Heinkel planning for the future?

Rojan: We are currently planning the modernisation of our product programme and the development of completely new machines, primarily with regard to the inverting filter centrifuges, the horizontal peeler centrifuges in kilo-lab and laboratory applications, and the dryers. We then want to transfer the developments from one area to others. For instance, the PAT and counter impulse process of the centrifuge dryers are also to be used with other systems.

cav July 2006