Drying – Fast, Reliable and Likewise Gentle

Drying is an inherent part of many production processes. At the time operators decide to invest in a new facility, they take a smooth drying process for granted. If drying then turns out to fall short of such expectation it might even obstruct the whole process. This is why it may be worth looking at an alternative drying method meeting the requirements of latest process technology.

Les opérations de séchage sont des composants essentiels de nombreux processus de fabrication et de traitement. Lorsqu'ils investissent dans une installation, les exploitants s'attendent à disposer d'un procédé de séchage absolument parfait. En effet, si celui-ci dysfonctionne, il peut bloquer toute la chaîne de fabrication. Aussi vaut-il la peine d'envisager un procédé alternatif satisfaisant aux exigences d'une ingénierie moderne.

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A closed, heat pump based system is capable of drying fast, reliably and at low temperatures. Hundreds of such condensation drying systems have already been implemented in various industrial sectors. What we are talking about is heat pump based condensation drying with its centrepiece – the so-called Airgenex dehumidification technology. It was developed by drying system manufacturer Harter more than 25 years back.

Heat Pump Based Condensation Drying

This drying process follows an alternative physical approach distinguished from conventional methods. It combines seemingly conflicting features such as low temperatures and short drying times. It meets the special requirements of optimum drying by highly efficient air dehumidification which works as follows. Extremely dry and thus unsaturated air is passed over or through the items to be dried. The air quickly absorbs any humidity present by physical action. The moisture-laden air is stripped of the humidity it carries in the dehumidification module. The humidity condenses and the condensate is drained off the system. Subsequently, the cooled air is reheated and passed on. The circuit is closed. Thus, the drying cycle is almost emission-free. Drying is effected at temperatures between 20 °C and 90 °C as required by the specific product or process.
The Airgenex dehumidification module controlling the conditions inside the dryer is either attached separately or integrated in the overall drying system as required for the specific application. It does not matter if the system is continuous or batch type. This flexible system may be used for drying any solid matter and for any type of process.

The Right Air at the Right Place

Highly effective dehumidification, however, is only one requisite for drying to be successful. The second critical factor is correct air routeing inside the dryer. "Dry air is worth nothing unless directed to where it is supposed to take up moisture" says Reinhold Specht, managing owner of Harter and one of the persons who developed this technology. "We build an air routeing system that perfectly suits the specific product and process. Only this way do we achieve complete and uniform drying."
The hardware design to ensure perfect air routeing is a specialty of Harter and requires much experience and know-how. Operators may boost their pro-

Fig. 1 – Racks entering the dryer after anodizing. Components are dried completely and stain-free at a temperature of 65 °C for 15 minutes.

Fig. 2 – Comfortable in-line drying is state-of-the-art. The bulk material shown is dried in a reliable and gentle way at a temperature of 75 °C for eight minutes.

duction in this way. This quality improvement also means elimination of sources of undesired cost and deficiencies. Airgenex condensation drying may be used in many applications. Here are some examples.

Short Drying Time for Racked Items

Polymeca AG of Heerbrugg, Switzerland, manufacturer of precision mechanical parts and surface finishes, invested in an Airgenex rack dryer to improve the drying quality while reducing the energy consumption of their existing anodizing facility. The

Fig. 3 – Drying of filter pressed sludges may reduce weight and volume by as much as 60 percent. Disposal cost saving may be the same.

dryer includes eight special fans controlling the air recirculation system inside the drying chamber. The rack dryer is connected to the dehumidification module through an air ducting system. The air ducts are insulated to minimize heat loss. The dryer features a standard automatic lid system to retain the precious heat in the system.

Today, the anodized high precision parts are dried completely and stain-free at 65 °C, which is a challenging effort considering the complex geometry of the components with drill holes, undercuts and bottom holes. The drying time inside the previous dryer was between 25 and 40 minutes while the new dryer finishes the operation within 15 minutes. The optimized anodizing facility allowed a higher output to be achieved. The connected load of the new drying system is only 9 kW while that of the old dryer was 33 kW. The energy consumption is thus reduced by 70 percent. There is also no more need for rework such as removing water from bottom holes by compressed air blowing or wiping stains from surfaces (ref. fig. 1).

In-barrel Drying of Bulk Material

One of the major milestones was in-barrel drying, either static or with minimal intermittent movement. Harter developed a special half-shell technology for this application. Hundreds of barrel dryers have meanwhile been built although some circles entertain the dogged belief that in-barrel drying is impossible. Here is an example to prove the contrary.

Stalder AG of Engelburg, Switzerland, has a new barrel galvanizing facility that does without the detrimental and time consuming centrifugation. The integrated barrel dryer can dry bulk material within the cycle time of eight minutes, or even faster. The material is completely dry. The drying temperature is 75 °C which prevents deterioration of both the material and the barrel. The compact barrel dryer including the dehumidification module has a total connected load of 15.9 kW and includes four special air recirculation fans. Drying in a closed system makes the process independent of the weather and the seasons. Absolute process reliability is ensured (ref. fig. 2).

Saving Cost by Drying Sludge

This drying method is also used to dry industrial sludges. Verzinkerei Kriessern AG of Kriessern, Switzerland, for example, have two type „Drymex M4“ standard sludge dryers in operation, in addition to their barrel dryers. They dry 1,000 kg of sludge per day. The weight of the sludge is reduced to 50 percent within 24 hours drying time. The high waste

disposal cost is likewise cut by 50 percent. There is also less transportation and other associated cost incurred.

Following mechanical dewatering in a chamber filter press, the sludge is filled in one of the two carts of the dryer. The cart is then manually moved into the sludge dryer. Drying starts once the dryer door is closed. The drying temperature is 50 °C. The process is fully automated and runs until the residual moisture content set is reached. Upon completion of the drying process, the sludge is dumped into a container and transported to a waste disposal site. While one cart is inside the dryer, the other cart stands below the chamber filter press ready to be filled.

The sludge dryers with integrated heat pump technology require only 0.4 kW per litre of water extracted. Conventional drying systems, by contrast, require 1.2 kW. The type M4 dryer has a water extraction rate of 500 litres/24 hours so that the power consumption is 200 kW per 24 hours. Various projects have shown that dried sludges might obtain a better waste classification. Recycling might also be an option opening up an opportunity for additional profit (ref. fig. 3).