Reliable Drying

An exhaust air free drying system with a heat pump ensures quality, efficiency and reliability

Dehumidification of jelly for medical pastilles requires low temperatures and a reproducible process. This also includes freedom from exhaust air and filtration.

Images © Harter

Various pharmaceutical manufacturing processes require drying at some stage. Drying may be needed to dehumidify agents or to remove water adherent to surfaces. If drying fails or does not work smoothly the whole process may come to a standstill. And, exhaust air is often an equally important issue for many manufacturers. Application examples demonstrate how an exhaust air free technology can yield quality results while reducing energy cost.

Keywords
- *Drying*
- *Process Air*
- *Pharma Application*

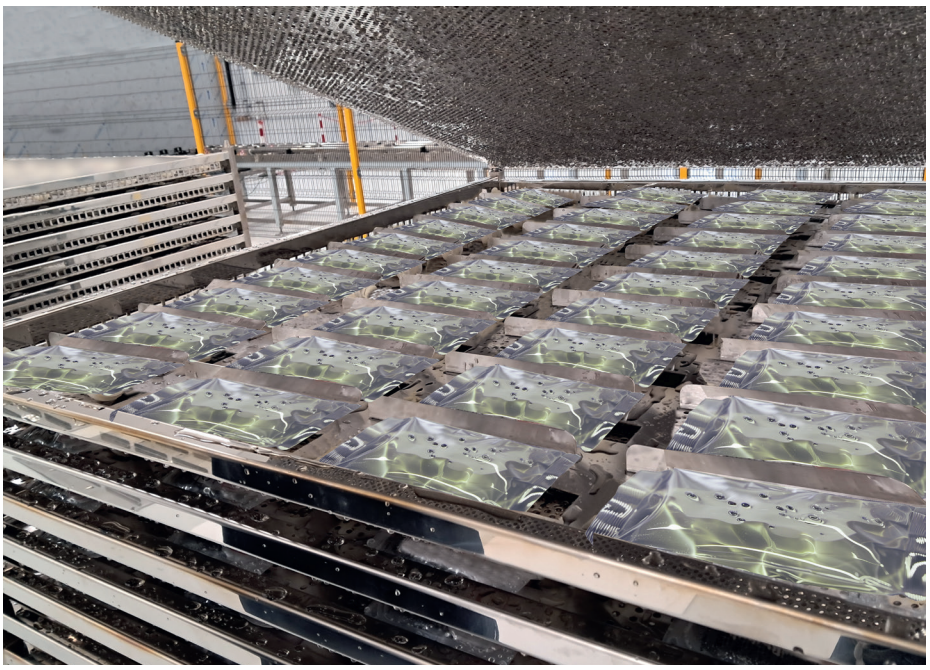
We are talking about so-called heat pump based condensation drying put on the marked by drying system manufacturer Harter more than 30 years ago. The German company developed the system such that the process air flows in a closed circuit. With exhaust air free drying, issues like the need for filtration or the dependence from climatic fluctuations cease to exist. Production environments and cleanrooms remain unaffected. Reinhold Specht, managing owner of Harter, explains: „The main criterion for investing in our heat pump drying has always been the fact that we have achieved drying results which can obviously not be achieved by conventional processes."

Dehumidification of Packing Surfaces

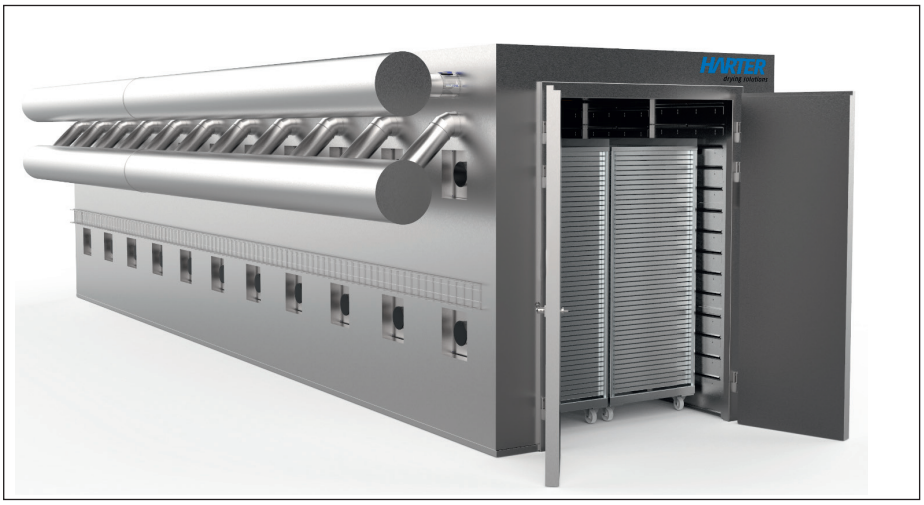
A US pharmaceutical company required post-sterilisation drying of their infusion bags, that is the wet surfaces of packings. Bags not perfectly dry may not undergo further processing or may even be condemned for leakage by quality control. As in any project, Harter initially performed drying tests in their Test Center. This is the place where products are tested and, sometimes, new product ideas developed. During such tests, an engineer determines parameters such as time, humidity, temperature, airflow rate, air speed, and the important air routeing. This approach provides a solid and reliable basis for the design of a drying solution.

In this case, the challenge was high. Bags of various sizes and contents lie side by side on trays while each batch has the same size. 21 trays each are stacked on a rack. Four of these racks are sterilised at a time within 90 minutes. Tests demonstrated that heat pump drying was capable of drying the infusion bags within the specified cycle time. Today, leaving the hot spray station four racks are inserted in the drying tunnel and rendered completely dry at 70 °C in a fully automatic operation. The rated power of the drying-cooling tunnel in production operation is about 38 kW. For the implementation of this project, appropriate air routeing was essential to ensure that all bags were reached by the same quantity of unsaturated process air at the same time. The times of wet products are over.

„Our success is based on a perfect combination of air dehumidification and air routeing", says Specht. The process air used is highly dehumidified. Its resulting unsaturated state makes the air absorb any humidity of the products readily and quickly. Now, the unsaturated air must be routed to flow over or through – rather than past - the products so that it actually absorbs the humidity present. Air conditioning and routeing as well as the condensation process takes place in a closed air circuit. Air and heat are retained in the system. Specht explains: „This project required extensive testing and much fine tuning of our technology in order to achieve this good and reliable result. Our Test Center is our powerhouse of ideas and the gateway to success."



Infusion bags lie densely packed in trays arranged in stacks of 21. Extremely dry air and appropriate air routeing make it possible to completely dry all bags at the same time.



The dryer for pastille production consists of 11 chambers and accommodates a total of 132 pallet racks. The rated power of the heat pump dryer in production operation is about 33 kW.

Drying of Jelly

A manufacturer of medical pastilles used a drying system that entailed very long drying periods and was highly susceptible to climatic impact. The substance from which the lozenges are made – liquid jelly – must not be dehumidified other than at low temperatures. One week's drying time, the need for continuous response to changing weather, and an exhaust air problem made the manufacturer switch to heat pump drying by Harter. In this case, a Harter engineer performed the tests using a laboratory dryer at the prospective customer's premises because the in-mould jelly could not be transported to Harter. The manufacturer has meanwhile a number of drying systems by the German company in operation. The biggest project comprised six chamber dryers of identical design. Each chamber dryer has 11 spaces to put racks in. The total number of such spaces is thus 66. The drying chambers are 10 m long and 1.7 m wide each. The drying process is now as follows.

As before, plastic trays are filled with starch in which the desired shapes are punched with a die. These recesses form the moulds in which the jelly-like liquid is injected. The trays are stacked on special pallets, and the pallets moved into the chamber. Each drying chamber accommodates 2 * 11 pallet racks, two side-by-side each, totalling 22. Altogether that

These stainless steel barrels required extensive series of tests to find an engineering solution for drying their interior surfaces.

This is the drying cabinet in which the barrels are dried at 70 °C and then cooled to 40 °C within the customer specified 30 min period.

makes 132 racks in all chambers. The trolleys are manually moved into the dryers.

Each batch includes 2,000 kg maximum of liquid jelly. The jelly is dried about 40 °C to obtain the dry matter content specified by the manufacturer. Upon completion of the process, the pastilles have the exactly defined consistency, and the remaining weight of the batch is about 1,300 kg. The drying period is about 72 hours today. The drying period is more than 57 percent shorter than before. The dryer is made from 1.4301 stainless steel and complies with GMP requirements. The whole facility is in continuous 24/7 operation and has a power rating of only 33 kW.

Complex Geometries

Drying of stainless steel barrels was quite a different application. These barrels are used by the manufacturer for handling their pharmaceutical ingredients. Being transport containers the barrels must be cleaned and, consequently, dried before reuse. The company had acquired a cleaning system with integrated drying provision. The latter, unfortunately, did not keep what it promised. As so many other operators, the company did not know this until the system was in production operation. The barrels had to be manually blown dry after cleaning which cost much time and money. „This is a situation very often encountered in our day-to-day business“, reports Specht. „Many of our customers are facing problems with their existing drying systems because, when acquiring them, they tacitly proceed from the assumption that they would just work – which they often do not do.“

The customer specified an exact residual humidity to be met by the internal and external surfaces of the barrels. The barrels have volumes of between 10 and 30 litres and dissimilar geometries: While some are tapered, others feature a seam that was much of a challenge for drying. Also, the different wall thicknesses of the barrels have an impact on the drying process. The biggest challenge, however, was the small opening of the barrels. How all these features would respond to drying was the subject of tests conducted by Harter in their Test Center. For the pharmaceutical supplier in question, very extensive series of tests with largely varying parameters were conducted to arrive at the final solution: a drying-cooling station.

Today, the drying chamber accommodates a carrier with barrels of various sizes suspended with their mouths facing down. Air routeing is critical. Harter developed an engineering trick which may not be disclosed in detail for know-how protection. The technique ensures that the process air can get inside the barrels and out again. This way, the inner and outer surfaces of the stainless steel barrels are dehumidified by the dry process air. The drying temperature is 70 °C. Lower temperatures would have resulted in failure to meet the 30 min process time requirement. Cooling at 40 °C also takes place within the specified half hour period. Barrels of any size and geometry are rendered completely dry within this this period, and may then be filled with new ingredients again. „With us, customers have a reliable, state-of-the-art technology and a reliable development partner at their side“, says Specht in conclusion.

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