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## Heat Pump Assisted Drying Gain Quality, Save Energy

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Heat pump based condensation drying is a highly efficient process used to dehumidify food, packages and even whole rooms in a reliable, gentle and energy efficient manner.

Drying system manufacturer Harter has been on the market with their proprietary process since 1991. The German company has since realised more than 2,000 drying projects to resolve problems, stabilise processes and also, now and then, to contribute to developing new product ideas. Harter is primarily driven by an innovation mindedness that is also reflected in their in-house Test Center. The Test Center is the place where specialists run series of tests and create new ideas for engineering solutions. This is then reflected in the design of the heat pump integrated in each drying system. For food applications, solutions may be chamber, barrel or belt type dryers. Sometimes, there are also very special projects such as the dehumidification of a sausage producer's work area. Each solution is backed by Harter's expertise gained over

more than 30 years in the business. Harter's drying systems ensure targeted dehumidification, and may also include temperature equalisation or cooling stages. Here are some examples to give a short glimpse on the various applications possible.

### **From Herbs to Infusions**

Organic cultivation is very important for manufacturers of organic and health products. Gentle processing of the plants includes gentle drying to preserve their precious ingredients. Only in this way may the health promoting power of the plants take full effect. The existing dryer of one such manufacturer was getting on a bit and was to be replaced by a state-of-the-art, efficient and quality system. Stephan Ortmann of Harter Technical

Sales reports: „They specified drying at low temperatures to a defined residual humidity. Besides these two important aspects, the dryer should also be versatile enough to be capable of drying their large portfolio of products including various herbs and fruit parts.“

As always, the series of tests conducted provided evidence of feasibility, furnished processing parameters, and offered the suitable solution: a chamber dryer with a multifunctional trolley. The associated pans accommodate plant parts filled about 50 to 60 mm high. The grain sizes vary between 0.3 and 6 mm as applicable for the specific product. 40 pans maximum with a useful volume of 14.5 litres are placed on each trolley. The herbs and fruit parts are gently dried at 50 °C today. The infusion ingredients are uniformly dried for about six hours to achieve the desired four percent residual humidity. Absolutely uniform drying of bulk material is one of Harter's specialties. It is based on the sophisticated routing of the extremely dry process air. Where drying in single layer is desired, the pans are replaced by trays. Air routing is adapted with little modification to achieve the same quality results.

Low temperatures combined with a closed air circuit have always positive effects on the ingredients, aroma, appearance and, sometimes, the feel of the food.

### From Sausage to Packaged Snack

Much different requirements apply to the drying of packaged products. Cycle times are often short and drying feasibility as such remains to be proven. The seams of standup pouches placed separately on conveyor belts, for example, are often prone to some water entrapment. For bulk material, on the other hand, the parameters to ensure uniform drying in a pan need to be determined. One special project was the drying of packaged snacks of a popular manufacturer. Certain markets prefer cooked sausage snacks. The sau-



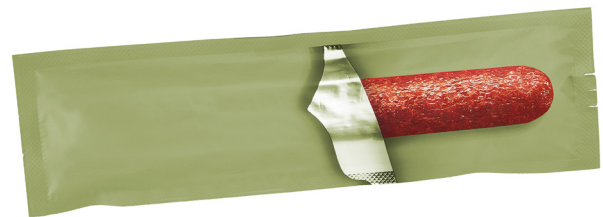
*Fig. 1 Drying of herbs and fruit parts to become precious and aromatic infusion ingredients is accomplished with a versatile chamber dryer. Absolutely uniform drying takes place at 50 °C in a closed air system - without producing any exhaust air.*

sage sticks are pasteurised after cooking and require subsequent drying. The situation at that time was that the pouches were dried by compressed air blowing in a tunnel. The pouches were placed in lattice boxes which, in turn, were inserted into the drying tunnel by a chain conveyor. Following drying, the pouches were still damp and required storage space for complete drying. The process was noisy and annoying to the employees, the energy expenditure was high and costly. While the snack manufacturer considered using a continuous solution, Harter developed a batch solution. The latter was much more favourable in all respects of internal material flow.

Today, the whole pallets loaded with baskets are completely dehumidified in a chamber dryer following autoclaving. The chamber dryer features five individual chambers. Each chamber accommodates the same volume as the autoclave and may be operated independently. Once a given chamber is loaded using an electric pallet truck, the drying-cooling process is executed fully automatically. The mini salami sticks are dried at 50 °C and then cooled to 38 °C in a downstream cooling stage. The whole process takes 60 minutes including the 20 minutes spent on drying. The Harter system meets the customer specified requirement of about 0.015 g residual humidity per package. Subsequently, the snacks are forwarded for further packing. The humidity extraction rate is 33 litres per hour on average. The rated power of the system in production operation is about 54 kW. A touch panel integrated in the system control visualises the whole sequence of operations. Ortmann explains: „Although this drying-cooling solution changed the process, the existing qualification in respect of the product temperature was not affected.“

### Of Moisture in Rooms

„An entirely different application in the food sector was the project of a room air dehumidification. When



*Fig. 2: Closely placed sausage snack packages are dried and cooled after pasteurising. The previous annoying compressed air blowing was replaced by efficient and reliable heat pump based drying.*

perishable products are cooled and then transferred to warmer production areas for continued processing, condensation becomes an issue”, says Ortmann to explain the situation. The resulting water formed on the surface of the products promotes the infestation by and reproduction of undesired bacteria so that food spoilage is accelerated. In the absence of a fully automatic production chain, manufacturers require solutions to ensure constantly dry production areas. Another factor to be considered, by the way, is what is also important in other applications, namely that whenever environmental air finds its way into any process then the processor becomes dependent upon the climate and the seasons and requires high filtering effort for compensation.

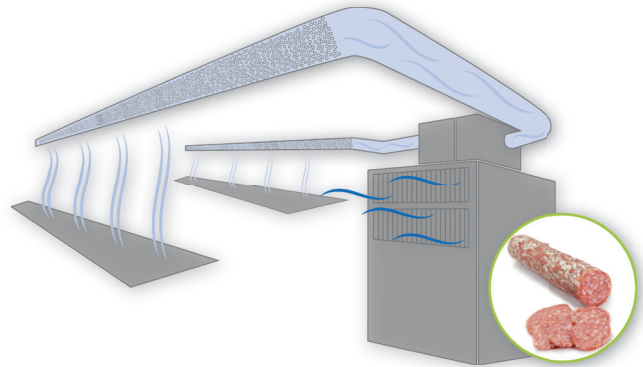
Exhaust air free condensation drying is also used to dehumidify rooms or, as in this application, individual workplaces. Harter installed a dehumidification system at the level above the processing area. The system includes three heat pump modules. The dry air with

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a temperature of 5 °C and a humidity of 2 g/m<sup>3</sup> enters the processing area through openings in the ceiling. An air ducting system directs the dry air to the individual workplaces at the processing machines. The unsaturated process air absorbs humidity there and is then returned, in saturated state, to the heat pump modules. The air passes a cooling stage and condenses to form water which leaves the system. The process air is reheated and passed to the room to be dried. This is a closed air circuit. Freedom from exhaust air makes low energy heat pump based drying even more efficient. And independent of any changes in the weather.

Daily production ends after two eight-hour shifts. During the third shift, the room is cleaned, a process that fills it with a thick fog. The drying system refined by Harter restores the ambient conditions required for the first production shift starting the next morning.

Harter dryers were classified future fit technology eligible for government subsidy years ago. The high energy and carbon savings which may be achieved using heat pump assisted drying make this technology attractive in terms of ecology, quality and economy.



*Fig. 3: Harter's heat pump based technology is also capable of removing moisture from production areas. A sophisticated air routing system enables individual workplaces to be dehumidified.*

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