

Tests in the Test Center Provide Clarity

Heat pump dryer design based on drying tests

Harter developed their heat pump based condensation drying technology more than 30 years ago and has optimized it ever since. For ten years now, the technology has been successfully employed in the food sector, too. The German company has operated an in-house Test Center from the first to conduct feasibility tests and to determine parameters. Prospective customers may satisfy themselves, with their own eyes, of the efficiency of low temperature drying.

The Test Center is the place where Harter's ideas are forged. Harter has always used this center to test the products of prospective customers for response to temperature, time, humidity, air speed, and airflow rate. Once the drying system specialist had gained a foothold in various industrial sectors, they have been expanding their Test Center. Today, they operate a separate laboratory for drying tests of food and active pharmaceutical ingredients. Several multifunctional dryers are available to determine the drying properties of the products.

Food engineer Fabian Baur is responsible for conducting the tests and he explains: "Besides the discussion with the customer and making the necessary technical arrangements (for the tests), the services we offer include the evaluation and interpretation of the test results, and the preparation of a comprehensive test report." These are the necessary steps to obtain a solid basis for designing an appropriate drying system. It totally depends on the product and the process whether a series production or a special drying system will ultimately be used. Many applications are also product ideas which manufacturers present to Harter. Development is much of an issue in this creative environment. "It happens now and again that our tests suggest an idea which the prospective customer did not have on their radar before," reports Stephan Ortmann of Harter Technical Sales with a chuckle. Here are some recent examples from the Test Center to illustrate the manifold opportunities.

Classic tests in a chamber dryer

Drying in a chamber dryer is the most frequent application both in the Test Center and later in the field. For this purpose, Harter developed a solution including a multifunctional trolley. The trolley accommodates trays and pans. This enables drying of items in single layer as well as dehumidification of material in bulk. The two options are made possible by a change to the air routing provision using a clever engineering trick. The normal application, however, is the drying of bulk material or products in multiple layers such as fruits, herbs, spices, edible nuts and so on.

According to Baur, there are customers with a very diverse product portfolio. For them, a versatile chamber dryer is the ideal solution. The food engineer conducts various product



■ Fig. 1 – The control board of the chamber dryer in the Test Center gives Fabian Bauraquick and easy access for varying the parameters for the individual tests runs. The best parameters obtained are ultimately stored as a recipe.



■ Fig. 2: Table salt was dried in a barrel slightly rotated continuously to obtain a uniform less than two percent residual humidity. The time required for the process was only 40 minutes.

tests for such a customer. "Drying in single layer is a good choice for pasty products such as fruit leather, sensitive raspberries, granulates, or meat and sausage products," explains Baur. Pans and trays for the chamber dryer are made from stainless steel or plastic – for test purposes as well as for the field process. The customer informs Harter of their quality requirements and of the known properties of their product. With this information on hand, the choice of the material – plastic or stainless steel – normally falls into place.

The drying tests will, however, be conducted in a so-called compact dryer. This is a smaller sized and even more versatile chamber dryer model. The dryer needs much smaller product quantities for processing, which facilitates logistics and reduces cost for both parties. Changing the internal route of the air with little manipulation Baur prepares the dryer for the alternative application. A special continuous process may indeed be simulated in this lab dryer – multiple belt drying.

Special tests in the barrel dryer

Barrel drying is offered for less sensitive bulk material. These are frequently products which would stick together when subjected to regular batch drying, and therefore need to be minimally moved intermittently. Typical examples include pomace, horseradish, hemp seeds, and roots. Periodic and smooth movement of the material to be dried often reduces the period required for drying. Barrel drying is also the answer to continuous production processes.

Baur reports of his most recent test of an entirely new product – coarse-grained salt. "The customer wanted a reduction of the drying period plus a reproducible process," says Baur who tested a 5 kg sample in the



■ Fig. 3 – This example shows brewer's spent grain on a conveyor belt. All such tests are used to determine parameters such as bulk height, belt and air speed. They provide information about where to place drops, how many drops to use and, ultimately, the ideal design of the entire drying solution.

lab barrel at the specified 50 °C temperature. The initial humidity was about eight percent. So, the salt was no longer a brine but also not flowing freely. After 40 minutes, the dry matter content was in excess of 98 percent. "So, we had thoroughly surpassed the prospective customer's expectations," says Fabian Baur and explains the perspective: "This experience suggests that the drying period in the dryer finally designed and built will definitely be shorter."

Automatic continuous operation

A belt dryer is meanwhile also available in the laboratory. We received an increasing number of enquiries about systems with a higher degree of automation last year. Companies using continuous processes or intending to reduce staff may find belt drying a viable option. Although Harter has periodically built single and multiple belt dryers in more than 30 years of drying experience their share of the total sales was rather small. "For food and pet food, the emphasis seems to be shifting now", says Ortmann. "And we can respond accordingly."

Last year, Harter received an enquiry by a milling company who wanted to dry wheat extrudate. The extrudate is used to fabricate vegetarian or vegan burgers. Owing to the very special properties of the extrudate a continuous drying solution turned out to be ideal. This was clearly demonstrated in tests with various dryers. Today, the plant produces 2,000 kg of wheat flakes an hour continuously dried in bulk about 120 mm high. First, the material is sterilised at 90 °C for about one minute. Then, the flakes are dried at 70 °C for



■ Fig. 4 – "It happens now and again that our tests suggest an idea which the prospective customer did not have on their radar before", reports Stephan Ortmann of Harter Technical Sales.

another 10 minutes. The final residual humidity is 10 to 12 percent, as specified. Tests in the Test Center were an indispensable condition for this solution.

Characteristics of the technique

The German drying system manufacturer has realised some 2,000 industrial drying projects to date. Their wealth of experience is commensurately high. Harter's innovative drying systems ensure pinpoint dehumidification at defined low temperatures including temperature equalization or cooling stages if required. The integrated heat pump technology enhances the efficiency of the low energy technique, which is eligible for government grants in Germany, Austria, and Switzerland as of 2017. Further benefits of Harter's systems are due to their fully closed energy circuit. The process is significantly more reliable because operators are completely independent of the seasons and climatic fluctuations. "Our prospective customers are very often actually flabbergasted to witness or learn from the tests how positive the effects of low temperature drying are on the ingredients, flavours, and look and feel (of the products)," summarizes Baur in conclusion.

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