Heat Pump Based Condensation Drying

Gentle and Reliable Drying of Quinoa

A subcontract processor for premium quality nutritional supplements needed a drying system for the extraction of quinoa. He found heat pump based condensation drying to be the solution providing higher throughput, reproducible results, plus very high energy efficiency.

The subcontract processor was faced with the requirement to dry germinated quinoa in preparation for a subsequent extraction process. The ingredient extracted is further processed to become a dietary supplement and must be dried for this purpose. They had used a fan oven before which failed to provide the desired capability and reliability, and needed too much energy. So, the responsible project manager looked for a suitable alternative. He got a recommendation by a closely related company who had been using heat pump based condensation drying for years to dehumidify their apple rings and pomace. This low temperature process by the German company Harter saves much energy and carbon emission. This is the reason why German, Austrian, and Swiss operators of such drying systems may apply for government subsidy amounting to 40 percent of the acquisition cost. The specialised service contractor found the technology promising enough to contact Harter. The question was, of course, if the drying system manufacturer was able to meet the specifications by the prospective customer.

Tests Bring Clarity

Users may have their items undergo feasibility tests in Harter's pilot plant station. These tests are made to determine the parameters controlling successful drying. They form the basis for creating an adequate solution for the individual application.
The laboratory engineer took much time for drying quinoa, tested its drying properties, and applied their know-how. The results of the series of tests conducted were consistently positive. The prospective customer also made use of an additional service provided by Harter – they ordered a loan system for tests at their premises. They did their own testing then, upon instruction by a Harter engineer, subjecting quinoa to various conditions for two weeks. Temperature, above all, was critical. Both the customer and Harter ran extensive tests at temperature

The subcontract processes an extract of quinoa to produce a dietary supplement

Image: New Africa – stock.adobe.com

Image: Harter

For an extraction process, germinated quinoa is dried at 60 °C to obtain 92 percent dry substance. Drying is accomplished by heat pump based condensation drying.

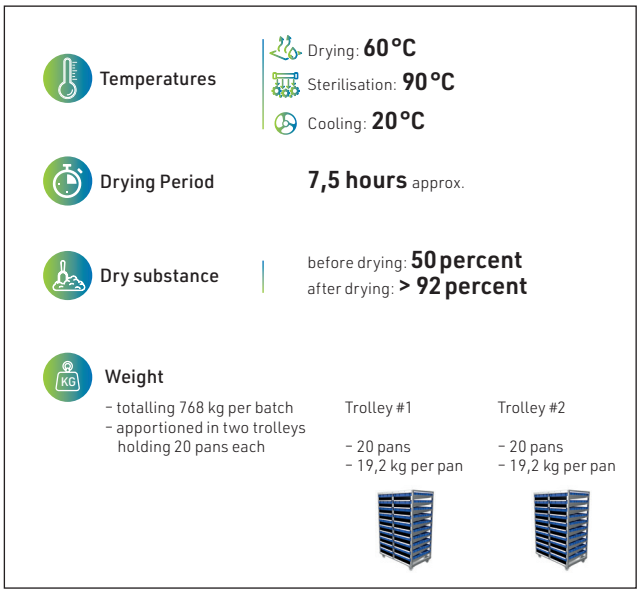

Image: Harter

Chamber drying process specifications

increments between 50 °C and 75 °C. Duly considering the desired throughput the drying temperature was finally established at 60 °C.

Quality and Reliability

Harter's drying systems always include a drying chamber. The design of the drying chamber will vary as required to meet the individual application. Another component of the system is the dehumidification module. It conditions the required process air and is responsible for the condensation process. This Airgenexfood module is always connected to the drying chamber through insulated ducting. It may be placed next to the drying chamber or, if space is restricted, in other locations such as on another floor.

For drying quinoa, Harter designed and built a chamber dryer. The drying chamber accommodates two standard trolleys holding 20 pans each. Each drying batch contains 768 kg of germinated quinoa. Equal shares of 19.2 kg are placed in each of the 40 pans. While the quinoa had to be placed in single layer before, it may now be dried in bulk heights of 50 mm. Following loading the trolleys are moved into the drying chamber, and the quinoa is dried at 60 °C. Processing includes a short-time 90 °C high temperature step for sterilisation. At the end of the process, the temperature in the chamber is reduced to 20 °C using the heat pump. This is to ensure safe handling by the workers of both the trolleys and the quinoa.

Initial water extraction is 60 l/h with the rate falling together with the humidity in the quinoa as drying progresses. The average water extraction is about 44 l/h. The specified 8 percent residual humidity is obtained within about 7.5 hours. The process is reproducible and the result is safely achieved in each batch run. The whole drying programme is storage programmable controlled. The hardware is stainless steel conforming to hygienic design standards. The rated power of the dryer in production operation is about 28 kW.

Dry Air Precisely Routed

Harter uses extremely dry air for heat pump based condensation drying. The air is passed over or through the items to be dried. As the air is unsaturated, it quickly absorbs any humidity present. The air is then cooled in the Airgenexfood module, and the humidity condenses to form water. Subsequently, the air reheated at two stages and returned, again at two stages, to the dryer. Air routeing is also critical for reliable and uniform drying. Air, by its very nature, follows the path of least resistance. This is why appropriate routeing is required to precisely target the unsaturated air to flow over or through the items to be dried.

The drying temperature may be selected between 10 °C and 90 °C as required for the specific product or process. The drying period depends on the degree of the residual humidity required or desired. Where the wet package of packaged food is to be dried, the specified cycle time to be met is often in the order of one minute. Where unpackaged food is to be dried, the drying period may be longer and is often determined by other parameters.

Harter's system uses a completely closed air circuit. This has very positive effects on the appearance, flavours and ingredients of the food dried. Exhaust-air-free drying provides more benefit, yet. Operators become independent of climatic conditions and the seasons. To sum things up, the subcontract processor states their change to condensation drying was of much benefit for them. They now have higher throughput, very good quality, a reproducible process, and a very high energy efficiency.

www.prozesstechnik-online.de
Search word "Harter

AUTHOR
MICHAEL RICHTER
Technical Sales,
Harter