

# The Art of Drying

## An Alternative Technology on Its Way into Food

Producers, large or small – drying is often required in industrial food processing. Drying has a major impact on product quality. A not-so-new but still innovative drying method is capable of drying in a gentle, reliable and energy-saving way at low temperatures.

What we are talking about is so-called heat pump based condensation drying. This is a process capable of drying any product at low temperatures between 20 °C and 90 °C as required for the specific application. This is done by passing extremely dry and thus unsaturated air over or through the items to be dried. In this process, the air quickly takes up any moisture present. The moisture-laden air is then stripped of the water it carries by a dehumidification module. The moisture condenses and the condensate is drained off the system. Subsequently, the cooled air is reheated using the energy recuperated and returned for drying. The circuit is closed and

thus almost emission-free. The dehumidification module controlling the environmental conditions inside the dryer is an integral part of the drying system, no matter if the system is a batch or continuous type. Drying system manufacturer Harter of Stiefenhofen, Germany, developed this process more than 25 years ago. The drying method was used in automotive and electronic applications for many years until, some years ago, pharmaceutical and also food producing companies began to appreciate the advantages of low temperature drying. Harter developed the Airgenex®med and Airgenex®food in response, based on the existing Airgenex®

condensation dryers. Meanwhile, a small series model of the Airgenex®food trolley dryer has been introduced on the market for small quantities of quality food.

### Gentle Drying of Berries

The one thousand plus industrial applications in the past required customized systems to be designed. Our new small series dryer for food can cover a large variety of applications. This multifunctional trolley dryer was first used to dry aronia berries. The producer had processed the berries into quality juice before. They intended to expand their product portfolio by also offering dried berries. So they were looking for a gentle method to retain the precious substances in the dried berries.

And they found the heat pump based condensation drying process provided by the new standard trolley dryer. This dryer consists of a drying chamber and an integrated dehumidification module. The associated trolley is Europallet size (1,200 by 800 mm) and provides ten supports. Each support accommodates four food safe plastic pans sized 400 by 600 mm. The maximum fill level of the pans is 70 mm. The total volume which may be processed in one batch is thus 0.65 m<sup>3</sup>. The drying pans have a special perforation to ensure uniform passage of air through the material to be dried. The aronia berries are gently dried at 40 °C to achieve the desired consistency and residual moisture content.

Bulk material inevitably requires very special and targeted air routing to ensure complete and uniform drying. To provide this, Harter relies on experience gained in hundreds of bulk material drying projects realized in other industrial sectors over the past ten plus years. Harter is extremely flexible in trolley dryer design and prepared to meet the requirements of any novel production idea. The trolley may be equipped with trays or pans of various sizes and designs. This allows drying of products placed in one layer or at filling heights of as much as 100 mm. The trays/pans may be exchanged or rearranged in almost no time to make the trolley ready for the specific application.



■ Fig. 1 – The Airgenex®food trolley dryer includes a multifunctional trolley holding trays, pans or baskets in which food is gently dried.

## In-container Drying of Almonds

An altogether different application was the drying of sun-dried almonds to achieve less than five percent residual water content in preparation for subsequent grinding to almond purée. The customer specified drying temperature was 90 °C. Harter designed a stainless steel drying chamber with four stations in a row. A container holding about 500 kg of almonds is inserted in each station. The filling height is 550 mm on average. The container has a special aeration bottom to ensure free passage of air through the almond load. The drying system includes a total of eight containers with a lid system. While four containers are in the drying process, the remaining four containers are being filled.

All containers meet hygienic design standards and may be thoroughly cleaned. The drying time is four hours on average depending on the size of the almonds. Upon completion of drying, the almonds are removed by a suction system and passed to the grinding station. The drying stations have insertion assist provisions and a special air recirculation system which ensures uniform distribution of the process air. The Airgenex® food dehumidification module is attached on a steel platform above the drying chamber for space restrictions and ease of maintenance. This drying system, too, has an additional cooling provision installed. Following drying, the almonds are cooled to about 30 °C for 30 minutes. The drying system design provides for flexibility – partial loads may be dried and the temperature is variable. This design basically allows also other products to be dried at low temperatures. The drying system may be expanded if the customer intends to raise their output.

## Reliable Drying of Packaged Food

As said before, heat pump based condensation drying may be used for any solid material. This includes food or pet food in primary packages. A manufacturer of sausage snacks pasteurizes a sausage intended for the UK market. These sausages require subsequent drying which should be gentle and dry the food completely and uniformly. The drying system to meet these requirements is as follows. Harter designed and built a combined drying-cooling system that dries the whole pallet immediately after pasteurization, without any reloading in order to save more time. The system comprises five drying chambers.



■ Fig. 2 – Almonds in containers are dried to a residual moisture content of less than 5 percent for subsequent grinding.



■ Fig. 3 – Packaged pasteurized sausage snacks are dried at 50 °C and then cooled to 38 °C in this batch dryer.

The number of drying chambers was selected commensurate with the load holding capacity of the autoclave to ensure a smooth production process. Following pasteurization, the pallets are loaded in these chambers using an electric pallet truck. Once the drying chamber doors are closed automatically, the fully automatic drying-cooling process starts. The sausage snacks are dried in their baskets on the pallet at a temperature of 50 °C and subsequently cooled to 38 °C. Upon completion of the drying-cooling process, the chamber door opens automatically again and the snacks can be immediately forwarded for further packaging.

The customer specified 0.015 g approx. per package residual humidity requirement is met. The five drying chambers are connected to the Airgenex dehumidification module controlling the environmental conditions inside the chambers. It has a connected load of only 9.5 kW and is capable of extracting

33l/h of water as determined by drying tests. Although the combined drying and cooling modified the process, the existing qualification with regard to the product temperature was retained.

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