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**Gentle, Fast and
Reliable Drying**

Heat Pump
Based
Condensation Drying



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Heat pump based condensation drying

Gentle, fast and reliable drying

Drying is an important stage of many production processes in the food industry. Excessive heat deteriorates many products. Hot air alone does not warrant good drying results. And ambient air, frequently used for processing, entails many disadvantages. Yet, there is an alternative approach to tackling all these challenges: the heat pump based condensation drying technology.

This low temperature drying technology has been successfully used in other industrial sectors for many years. With „successfully“ meaning short drying cycle times and quality drying results. Plus the products are dried gently at low temperatures—in an energy efficient way. The Stiefenhofen, Germany, based Harter Oberflächen- und Umwelttechnik developed an energy-saving drying technology more than twenty years ago. It has found hundreds of applications in the automobile industry. Renowned pharmaceutical companies have changed to condensation drying their products. This drying technology has resolved many an operator's drying problem and optimised their process. Its unique features make condensation drying attractive for the food industry, too. „We realised several projects within a remarkably short time. This is reason enough for us to spread the news about our technology in the food sector“, says Jochen Schumacher, Technical Sales.

The right atmosphere

Heat pump based condensation drying is a process capable of drying any solid matter at low temperatures between +20 and +90 °C as appropriate for the specific application. In the food projects realised so far, temperatures mostly vary about +40 °C. Extremely dry and, thus, unsaturated air is passed over the items to be dried. In this process, the air rapidly absorbs humidity as a physical phenomenon. This explains why the drying times are very short. The humidity-laden air is then stripped of the moisture it carries. The humidity is condensed and the condensate drained off. Subsequently, the cooled air is reheated using the energy recovered, and recirculated. The loop is closed. The drying cycle is thus almost emission free and requires very little energy. The dehumidifi-

cation module, which controls the environmental conditions inside the dryer, is part of the system. It does not matter if batch or continuous drying is used. This drying system may be adjusted to any drying technique. And, products to be dried may be from any material. Drying may be complemented by downstream cooling if required for the particular process.

Two pillars of success

Many years of experience with and in-depth study of closed-system condensation drying have taught us that there are two controlling factors for successful drying. Firstly, high-tech dehumidification, as described above, is a must. Secondly, but not less important, the air recirculation system inside the drying chamber



Heat pump based condensation drying is capable of drying apples cut into rings without the use of any additives.



The rings are allowed to dwell in the dryer at +40 to +50°C for 24 hours to obtain a residual moisture content of 15 to 20%.

must be adjusted to exactly meet the requirements of the specific application. Failure to do so will reduce the performance of the powerful dehumidification module. The air recirculation system installed in the drying chamber will always be purpose-built. The specific air volume inside the drying chamber is critical for high drying quality in short time. The essential factor, here, is air routing. The air must actually pass over or - if applicable - through rather than past the items to be dried. "Of course, the air wants to take the path of least resistance. So it must be forced to take the right path, an engineering effort which is one of HARTER's specialties", says Schumacher. The air speed to be

used for a specific product largely depends upon the nature of this product. The drying system design required for high density bulk material is different to that required for individual items. Also, the material's readiness to release humidity must be taken into consideration. The air speed, however, is always controlled to suit the sensitivity of the product to be dried.

Apple rings with intense aroma

An Austrian cider press operator uses a HARTER cabinet dryer for drying apples cut into rings without the use of any additives. These so-called apple rings are packed after drying and marketed as a dry fruit snack. The eight trays of

the dryer are loaded to full capacity with fresh apple rings. The rings are allowed to dwell in the dryer at +40 to +50 °C for 24 hours to obtain a residual moisture content of 15 to 20%. The operator claims their apple rings, once dried in an AIRGENEX® food condensation dryer, have become much more aromatic. Both manufacturer and operator suggest that enhanced aroma results from drying in a closed system where the same air is recycled again and again. This would probably not be possible with an exhaust type dryer. Also, the apple rings do not change colour so that they fully meet the appearance requirements.

Drying of hard-cured sausages

A Liechtenstein based manufacturer of hard-cured sausage was dissatisfied with their existing drying system. It tended to introduce humidity into the dryer, and the drying parameters could not be controlled to obtain the desired product quality. Instead, the drying times had to be varied with resulting discontinuous conveyor travel. The situation was calling for an alternative process. Through a plant manufacturer, they contacted Harter. Harter subjected the sausage to be dried to extensive tests in their in-house pilot plant and found that their condensation drying technology could easily meet the requirements for this specific foodstuff. So the Liechtenstein operator invested in an AIRGENEX® food condensation

Drying Systems

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dryer. This is a continuous application where the sausage meat is dried, within the time desired by the operator, while passing the drying tunnel on a conveyor belt. The drying tunnel has the AIRGENEX® food dehumidification module attached to exactly control the atmosphere inside the dryer. A built-in humidity sensor continuously picks up the degree of humidity inside the tunnel so that the relative air humidity may be controlled to the desired level. This necessitates fully automatic closed loop humidity control. The drying temperature is controlled by the operator with standard temperatures ranging from +40 to +60 °C. It was important for the client to obtain the exact post-drying sausage weight desired. The sausage must be adequately dried to prevent moulding and to obtain the desired best-before period. And it must be humid enough to ensure edibility.



Drying of packaging units

The items to be dried are stand-up pouches filled with pet food. After autoclaving, the pouches are naturally wet. They require drying before final packaging. The drying operation must be integrated in the existing process, and the drying technology must reconcile the requirements of the product and its properties,

Hard-cured sausages must be dried to an exact level so that they become durable and do not mould.

temperature and cycle time, or rather conveyor speed. For Harter, the challenge of this drying process was in finding the optimum air routing because the bottom gusset of the pouches is very difficult to be dried. The solution found is as follows. Pet food pouches weighing 100 g each are placed individually on a conveyor belt and dried in a continuous operation running through a 2 m long tunnel. The conveyor speed is

18.5 m/min. A total of 700 pouches per minute are placed on the conveyor. For energy efficiency, the entrance and exit openings of the tunnel are closed except for a slot 50 mm high above the conveyor surface. Upon request by the client, the AIRGENEX® food dehumidification module controlling the atmosphere inside the tunnel is attached above the tunnel. With a drying temperature of +60 °C, the stand-up pouches have the client requested dryness level upon leaving the tunnel. The whole AIRGENEX® food system is made from corrosion resistant steel and can be cleaned easily.

Good energy balance

Saving energy required for drying is gaining in importance. The German drying system manufacturer feels that this issue is gradually becoming a reason for investment rather than a „nice-to-have“. „That suits us fine because our technology rides this wave“, says Schumacher. AIRGENEX® food drying systems have a low power input. The heat recuperated in the closed system helps to cut cost. Benchmark studies conducted by automobile industry clients showed energy savings of up to 75 % compared with conventional drying methods. Figures for the food industry remain to be determined by Harter. For operators, it is still vital that their products be dried in a gentle and uniform manner at low temperatures. Other advantages include normally short drying times and variable temperature settings. Drying in the closed system makes processes independent from the seasons and resulting variations in the environmental conditions inside the workshops. The weather is thus essentially blocked off. This heat pump technology closes a loop which is reasonable in every respect.



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