

# HOSOKAWA ACTIVE FREEZE DRYER

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MIXING

DRYING

AGGLOMERATION



**HOSOKAWA MICRON B.V.**

Hosokawa Micron B.V. is a member of the Hosokawa Micron Group, responding to global needs through emphasis on materials science and engineering. The Group is an international provider of equipment and technology for powder and particle processing, plastics processing and confectionery products. The Group maintains facilities for research, engineering, manufacturing and service in each of the world's major industrial markets.

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**PROCESS TECHNOLOGIES FOR TOMORROW<sup>SM</sup>**



# Active Freeze Drying (AFD)

A quicker and less labor-intensive freeze drying process for bulk materials. The possibility of producing a non-lumpy and easy to process powder under low temperatures and low pressure.

Even this very brief introduction clearly illustrates that the Hosokawa Active Freeze Dryer can be seen as a big step forward in the field of freeze drying bulk materials as well as in powder-technology in general.

It offers unique possibilities for freeze drying various types of materials in a one processing step, always resulting in a fine loose powder. Material consistencies can range from solutions, dispersions to paste and even wet solids. Efficiency, minimal handling and product quality are the key benefits of this new, unique technology.

### How the Active Freeze Drying process works

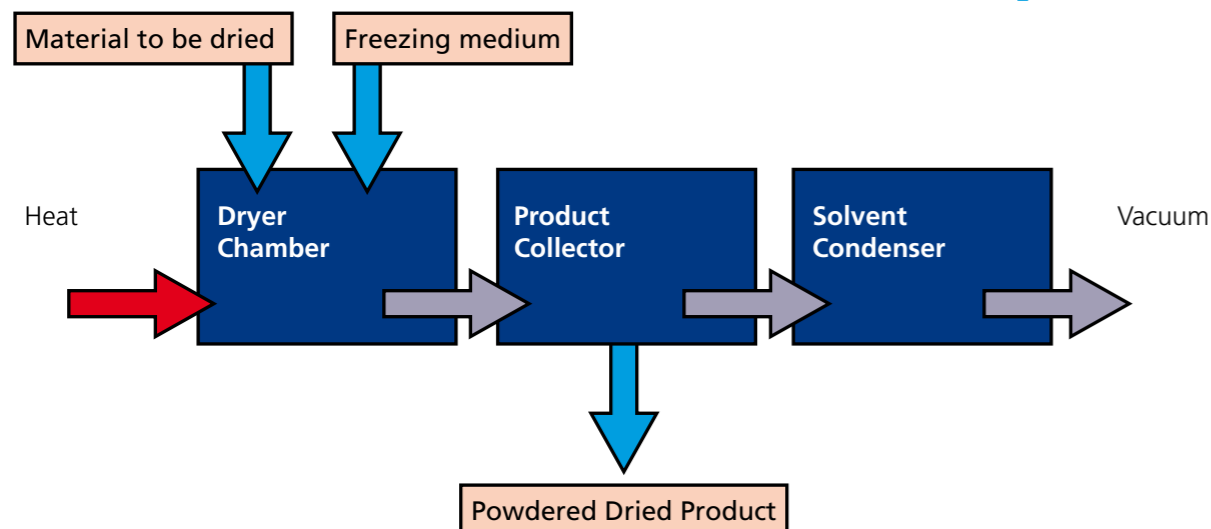
In an Active Freeze Dryer, the product is first frozen dynamically by moving it in a specially designed chamber. Whether the material to be dried starts off as a liquid, granular solid or paste, the forced motion inside the drying chamber ensures that it freezes in the form of free-flowing solid granules.

Once the product is fully frozen, a deep vacuum is applied and the sublimation starts. Heat applied to the vessel jacket

is effectively distributed throughout the product due to the dynamic environment. The initially coarse, frozen granules gradually reduce in size as the ice structure connecting the frozen material sublimates away, resulting in a loose powder consisting of fine, dry particles.

When most of the solvent is sublimated product temperature starts to rise, until finally it equals the jacket temperature. This marks the end of the freeze drying process, at which point all the material has been transformed into a fine free-flowing powder. Once the vacuum has been released, the chamber is opened and the **powdered** product can be discharged.

**Cost-effective** **High product quality**  
**Less labor-intensive**  
**Free-flowing powder**  
**Faster** **Simpler**



# Freeze Drying Technology



### Traditional tray freeze drying process

Ever since the 1930s, industrial freeze drying has depended on a single type of equipment: the tray-type freeze dryer. Despite the optimal structure of the individual product particles the product layer on the plates will usually form one piece of hard baked material. Often the product has to be crushed after freeze drying, which may lead to damage of the product structure. Another disadvantage is the relatively low heat transfer rate due to the static state of the material on the plates. Also the handling of the product is quite labor intensive because the trays have to be filled and emptied manually.

### Why Active Freeze Drying?

The Active Freeze Drying process is quicker and less labor-intensive than the traditional tray freeze drying process. This new process produces lump free, free-flowing powders in one processing step.

### Unique advantages of active freeze drying

#### Much higher capacities

In the Active Freeze Dryer, we created such an enlarged heat exchange capacity, that this is, unlike the conventional tray-freeze dryers, not a limiting factor anymore. A direct consequence is that our Active Freeze Drying system will normally be operating at the highest possible pressure (still being restricted in any case to the eutectic point of the solvent of course) and consequently will end up with much shorter drying times. For example in our 5 liter Active Freeze Drying system (3 liter filling volume) the sublimation rate can easily be as high as 0,5 kg H2O/hour.

#### No handling - no contamination

Without having to use multiple processing steps the AFD produces directly a fine powder in one processing step. It therefore does not need further processing like milling and/or classifying. Consequently the handling is significantly reduced, and perhaps more importantly: there is hardly any contamination possible (e.g. for sterile bulk materials).

#### High Product Quality

Due to the different, much faster technique of freezing the substrate a different product structure will develop. In the majority of cases an amorphous-like structure of the final product is the result (e.g. leading to better redispersability and free flowing properties). In addition to this the particle size of the final product is often very fine with a uniform distribution.

#### Less building area

The Active Freeze Dryer itself utilizes much less floor space than the conventional tray drying installations, which usually comprises of horizontal vessels, freezer and tray handling machinery. This is now all converted into a single vertical dryer.

### Typical Applications

#### Pharmaceuticals

Important applications of Active Freeze Drying are in the pharmaceutical industry, like antibiotics, APIs and electrolytes. Other pharmaceutical products typically produced by freeze drying include hormones, viruses, vaccines, yeasts, blood serum, liposomes and transplant materials like collagen sponge.

#### Food substances

Numerous successful applications are also found in food and food additive applications: the drying of herbal extracts, milk derivatives,

bacterial cultures, enzymes, yeast, broth extracts, molds, vegetables, lipides, insects, flavours, fibres, proteins and soups.

#### Special materials (e.g. nano materials)

Alternatively this new technology has proven its applicability in the freeze drying of special materials: nano materials, polymers, ceramics, pigments, fillers, lime stone, catalysts, glass powder and salts. For all these materials freeze drying is popular because it preserves the product structure, at low temperatures and it results in a final product which is easy to handle.