

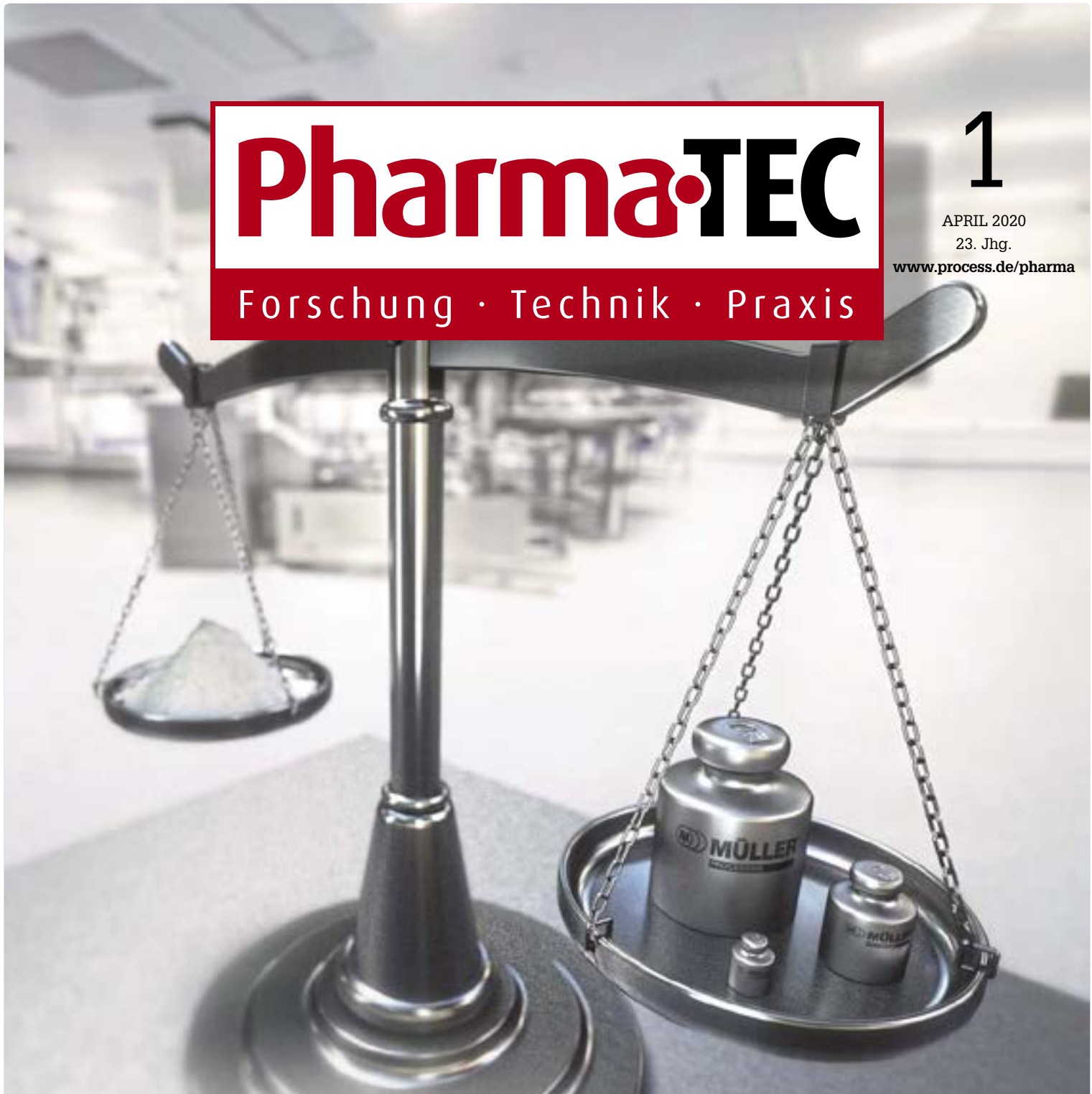
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drying solutions

Gentle Drying in a Cleanroom

GENTLE DRYING IN A CLEANROOM

Capsule Drying in a Cleanroom – Drying under cleanroom conditions quickly gets out of hand in terms of the sheer mass of hardware required for the purpose. This includes the ducting for fresh air intake, the classification of the process air, and so on ad nauseam. If you compare conventional convection type drying cabinets with heat pump based condensation dryers your choice in favour of the heat pump is easy. Unbeatable are its drying times, air exchange and energy efficiency – ample reasons to use an Airgenex dryer for drying capsules.

Drying in a cleanroom is a fiddly effort. Additional piping or ducting is undesired. Fresh air intake should be minimized. Drying should be fast, consume little energy, and not rely on interchange with ambient air, as possible, in order not to affect the cleanroom environment. Besides, the dryer should require little space, which tends to be scarce in pharmaceutical production.

A Very Special Item to be Dried

These requirements are difficult to reconcile, as Jens Ludwig, Production Engineering project manager of the Göttingen, Germany, based Sartorius Stedim Biotech is only too aware of. Plus he is dealing with a very special item to be dried – capsules sealed in plastic bags. The capsules are single use components for filtration in the pharmaceutical and biopharmaceutical industry. The company



Bild: Sartorius

View of the dryer used by Sartorius



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goes to great trouble with capsule production and packaging. Cleanroom conditions are requisite for capsule use in the pharmaceutical industry.

A Very Special Item to be Dried

And, of course, highest sterility. This is why the finish produced capsules are shoved into an autoclave for hot vapour to kill any microorganisms left. To ensure that the capsules remain sterile thereafter the plastic packaging bags have dissimilar sides one of which is gas permeable. It blocks off germs bustling in the air while allowing hot vapour in. "Hot vapour is an environmentally friendly and, at the same time, safe sterilization method", explains Ludwig.

Its only drawback – the condensed vapour precipitates to form minute droplets on the surfaces of both capsules and interior packaging walls. Quantities aren't huge, says the project manager, two grams maximum of moisture per filter element, yet enough to be visible by the naked eye. And pharmacists are discriminating users. "The customer expects high quality filter capsules with no visible moisture residues", says Ludwig to make it perfectly clear.

Water Droplets Disappear

So, a dryer should make the water droplets disappear quickly. Ludwig soon zeroed in on a drying concept not so widespread in the pharmaceutical industry as yet – heat pump based condensation drying. The physical background of the concept can be explained easily. Extremely dry and, thus, unsaturated air is passed over the items to be dried and "sucks up" the moisture present. The moist air is then passed to the Airgenex for dehumidification. The Airgenex is the system component in which the heat pump operates to extract the moisture from the air. The moisture condenses and the condensate is drained off the system. Subsequently, the cooled air is reheated and passed again over the items to be dried. Drying takes place in an air circuit which is closed at any time and, thus, independent of the climate. Production and cleanroom environments remain unaffected. The German apparatus manufacturer Harter developed the patented closed circuit process. They build customized drying systems for batch or continuous operation. Ludwig thinks the processing


times of Harter dryers are unparalleled, and emphasizes that an exhaust air dryer would not have produced the high flowrate of 11,000 m³/h in a cleanroom. The high mass of air recirculated in the system ensures that the packages are dried within one and a half hours. Drying the same quantity of articles in a drying chamber would take four days.

The heat pump was modified to meet Sartorius' special requirements. The cooling medium in particular had to be changed to cope with the high process temperature of 90 °C. In a joint effort by the production engineers and the system manufacturer, comprehensive preliminary tests were run to come up with a dryer configuration which meets pharmaceutical production requirements. The system includes a single chamber dryer and a high temperature module, and ensures a drying period that outclasses any competition.

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