BALANCING ACT IN THE SPRAY TOWER

Spray dryers are complex systems, and protecting them against dust explosions requires extensive know-how. Dairy firm Meggle is relying on the expertise of IEP Technologies to protect its newest installation. IEP Technologies, which became part of HOERBIGER in 2015, already proved its value by equipping the first system at Meggle’s location in Wasserburg am Inn, Germany, with explosion protection.

Text: Sabine Mühlenkamp  Photography: Siegfried Sperl
In addition to the active ingredient, pharmaceutical tablets additionally always contain excipients, which have no pharmacological effect. Lactose is used quite frequently as a filler and binding agent. Dairy firm Meggle is one of the world's leading manufacturers of pharmaceutical lactose.

Most consumers associate herb butter and other types of butter with Meggle's trademark – the blue clover leaf. “Our herb butter is arguably our best-known product, yet the pharmaceutical excipients field is also one of our core businesses and plays a decisive role in the company as a whole,” comments Albert Speckmaier, Head of Production for Functional Products at Meggle. Both butter products and lactose originate from milk. Meggle made a name for itself almost 130 years ago, initially with cheese, before it increasingly shifted its focus toward butter. Pharmaceutical lactose has meanwhile also evolved into a product with a 60-year-long tradition. At the time, the company was searching for a way to utilize the byproduct whey.

Pharmaceutical companies are not only discerning when it comes to the shape, surface, and size of the pills they manufacture, but also demand other functional properties, such as special hardness degrees, a particular disintegration rate, or sustained release of active substances. “We produce some 25 different lactose-based excipients,” explains Speckmaier. Ultimately, these products cover all solid forms of administration – from tablets, capsules, and sachets to powder formulations. “At the same time, lactose is an important delivery agent for the active substance to the lungs, for example when using powder inhalers,” Speckmaier adds. The deeper the active substance has to be transported into the lungs, the finer the lactose particles. The proper formulation is crucial, and Meggle is considered a specialist in this field.

**DRAWN-OUT PROCESS**

The consumer has no idea of considerations regarding hardness and disintegration properties when swallowing a tablet. And presumably the consumer is even less suspecting of the fact that producing this excipient is a markedly protracted process. Whey, which initially is still present in liquid form, passes through various process stages in as many as three days before the resulting lactose powder is ready for packaging.

Some of the lactose produced by Meggle is processed further in spray towers to obtain lactose that can be directly made into tablets. Many of these steps consume vast amounts of energy, which is supplied by a dedicated modern combined heat and power plant boasting an efficiency of more than 90 percent. The steam generated there is used to heat the spray towers and evaporators, for example. Producing lactose powder poses a challenge not only from an energy perspective, but also in other respects. Cost pressure has risen significantly in the health-care sector in recent years. “To be successful economically, these products can only be manufactured on an industrial scale,” Speckmaier points out.

**ANOTHER SPRAY TOWER PUT INTO OPERATION**

Spray dryers meet this requirement – the machines are extremely efficient to operate, though they necessitate special know-how. One advantage of the process is that it is rapid yet very gentle on the end product. Additionally, it allows a defined particle size distribution in the micro range to be achieved, a crucial factor for the quality of the product.

During production, the whey, after having been treated in several stages, is injected via spray nozzles from above as a fine mist into the extremely hot air of the dryer. This enormously increases the overall surface area of the liquid, convectively drying it. The drops are dried and the lactose powder is separated from the air in the bottom area of the tower.
“We now have extensive experience with this technology, since we have several spray towers on site,” Speckmaier explains. The first spray tower with Ex suppression, as it is also referred to, was put into operation ten years ago. Last year, the construction of another spray tower was started. The tower provides approximately one quarter more capacity and is about to be commissioned. The system is made primarily of stainless steel.

INDISPENSABLE PROTECTION

Only grayish-silver stainless steel? Not quite. Twenty-four signal red cylinders are installed at equal intervals around the entire tower – the tower’s life insurance, so to say. After all, while process engineering is important, explosion protection requires particular attention.

At first glance, it would seem perplexing that lactose powder could trigger an explosion. Nonetheless, a spray dryer offers conditions that favor explosions. “We have organic, extremely fine powder in a large volume of air and high temperatures. All that is missing for an explosion to occur is the third component for explosive conditions – the spark,” Speckmaier comments. By virtue of the high temperatures, there is a constant risk that powder deposits may spontaneously ignite.

Speckmaier knows how to handle this hazard, though. “Our engineering team worked closely with specialty firms in the construction of the tower. Spray towers are some of the most challenging installations in terms of explosion protection,” Speckmaier confirms. “This requires expert know-how.”

The selection of firms specializing in explosion protection was not particularly large when the first spray tower was built. IEP Technologies was chosen for the job – at that time the company was still operating under the name of Kidde. The explosion protection concepts made by IEP Technologies, which became part of HOERBIGER in 2015, can be found in approximately 80 percent of all current spray dryers. The reason is that only few companies have ATEX certification for very large cylinders.

1 If an explosion looms, the sensors detect the associated increase in pressure within milliseconds and respond in a fraction of a second by extinguishing the explosion.

2 and 3 A few weeks ago, the finishing touches were put on the newly built spray tower.

ALL-AROUND PROTECTION

As part of the hazard assessment, initially existing risks for areas prone to explosion based on possible ignition hazards were evaluated, and technical and organizational protective measures were initiated. Other explosion protection concepts, such as venting by way of rupture disks, were not an option due to the close proximity to residential areas, making open spaces for venting in the vicinity of the premises scarce.

Meggle decided in favor of all-around protection of the tower using IEP Technologies’ explosion suppression. The system consists of the aforementioned typical red suppressant storage cylinders, which are installed at various levels around the tower.
“SPRAY TOWERS ARE SOME OF THE MOST CHALLENGING INSTALLATIONS IN TERMS OF EXPLOSION PROTECTION. THIS REQUIRES EXPERT KNOW-HOW.”

Albert Speckmaier, Head of Production for Functional Products at Meggle
EXPLOSION PROTECTION IS A BALANCING ACT. WHILE SAFETY IS THE TOP PRIORITY, FAULTY ACTIVATIONS ARE ALSO UNDESIRABLE.
spray dryer as well as on other power units. The pressure sensors are configured to respond to the rise in pressure typical of an explosion. If an explosion looms, the sensors detect this increase within milliseconds and respond in a fraction of a second by extinguishing the explosion. The sodium bicarbonate (baking soda) that is introduced has a concentration of 700 to 1500 g/m³ and reduces the pressure effects of the explosion to 200 mbar or less, which otherwise could rise to 8 or 9 bar. The entire tower is designed for a pressure of 400 mbar to prevent it from being damaged. In principle, these systems operate self-sufficiently. However, they are connected to a control system to allow the machines to be shut down immediately if triggering should occur.

**EXPLOSION PROTECTION IS TEAM WORK**

Even a milk production plant requires inspections in accordance with the Ordinance on Hazardous Substances and is scrutinized and signed off in advance by professional associations and authorities. “The last acceptance inspection is generally not a problem, since the engineering team works very closely beforehand with the specialty firms and authorities,” Speckmaier explains. As a result, the tried-and-tested concept of the first spray tower was also used for the new spray tower. “We feel that it would not have made sense to bring another vendor on board – due to the more complex replacement parts inventory alone. Since the suppressors are also used in other parts of the plant, including in the food systems and on large dryers, we always keep replacement cylinders on hand,” says Speckmaier.

Several improvements have been made to the suppressant cylinders over the course of the past ten years, which primarily affect maintenance and servicing. Thanks to an inspection opening, the nozzle system is now easy to check by sliding in an inspection camera. Previously, this necessitated removal of the heavy extinguishing powder cylinders. Replacing the vessels has also become much simpler, thanks to the use of a bayonet catch in place of the former rigid wiring. While in the past three hours were estimated for maintenance, the annual inspection today is completed within fifteen minutes given the ease of accessibility.

Explosion protection is a balancing act. While safety is the top priority, faulty activations are also undesirable. This would require discarding the batch, halting production, and cleaning and restarting the spray dryer. “The anticipated costs associated with the related downtime would be significant,” Speckmaier adds.

It takes a while until production is back up and running, even when an explosion is quenched at the source. While the suppressant systems are replaced relatively quickly, it takes at least two weeks until authorities and the insurance company release the plant again.

Fortunately, such a situation has never occurred. “Still, this cannot even be compared to the damage that an explosion could cause without protection of the system. In addition to the potential hazards to people and the environment, damage to the equipment and losses from a production shutdown would be very high,” Speckmaier says.

This is why Meggle will continue to rely on IEP Technologies’ explosion protection concepts in future projects.

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1 Volker Krone, IEP Technologies (left), and Albert Speckmaier, Meggle, are delighted to work together once again.
2 Meggle’s headquarters in Wasserburg: at the left is a landmarked farmhouse that was integrated into the entrance.
3 The new spray dryer has 25 percent more capacity.
4 The key with pharmaceutical lactose is the proper formulation – pharmaceutical companies worldwide therefore rely on Meggle’s experience.