

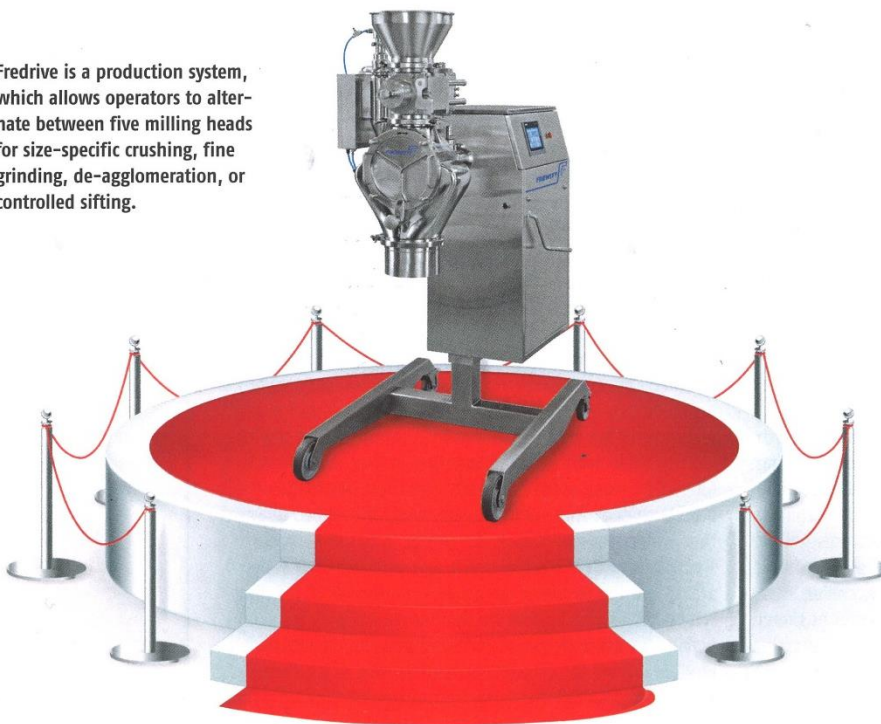
MILL WITH CHARACTER

There is no alternative to testing when it comes to grinding new products —

The mills used to manufacture pharmaceuticals are becoming increasingly diverse: New requirements are demanding optimised processes and innovative approaches. But the sums all have to add up in the end despite all the technical possibilities.



Fredrive is a production system, which allows operators to alternate between five milling heads for size-specific crushing, fine grinding, de-agglomeration, or controlled sifting.



NOTKER KLING*

So, when it comes to grinding new products, the path is often laid out. It frequently involves performing grinding tests on an existing device, evaluating the results, and adjusting the mill to the product properties. What results does this path lead to in practice? What obstacles have to be expected? And how can they be overcome?

Evaluations have been performed right down to the smallest detail in Frewitt's grinding tests laboratory for more than a decade. It has been even longer since tests were carried out on the different mills. The sheer volume of product properties needing examined is enormous. And an outstanding level of expertise is required too. So, does that mean that testing will be dispensed with in future? No. Quite the contrary, in fact, as nowadays, products demand more of the devices, are in some cases even more sensitive, and therefore have to be treated more gently than before.

It is no longer enough to know that a product is hard, fibrous, soft, sticky or sensitive to temperatures. There are products with properties that change when a temperature

Source: Frewitt, © Natis - stock.adobe.com

* The Author is Sales Manager Germany at Frewitt, Granges-Paccot/Switzerland. Contact: Phone +41-26-460-7400

of 40°C is exceeded during the grinding process. These products may even become ineffective if they are unintentionally heated up, as is the case with enzymes, for example. Due to these findings, Frewitt nowadays assumes that the suitable mill type can only be effectively determined following a series of tests, particularly when dealing with delicate products.

Spoilt for choice

While there are different ways to achieve the same goal, not all mills will produce the same result. Because neither Frewitt nor its customer knew beforehand which mill would be best-suited for the product tests, there was only one course of action: perform tests on different mills. The customer, which operates in the pharmaceutical industry, was already familiar from previous applications with a competitor's conical sieve mill, which had been used to grind the new product but failed to produce the desired result. Because the customer wanted to compare like with like, they decided to perform a series of tests on Frewitt's conical sieve mill, the Coniwitt. Due to the required throughput, it was agreed that the product would be ground on the Coniwitt-150, a mill with a conical sieve insert which, depending on the product properties, achieves a throughput of 500 to 1,500 kg/h and grain sizes of up to 150 µm.

From earlier test series involving products with similar properties, the testers at Frewitt surmised that the limit would be reached with the Coniwitt's capacity. In line with the saying "Better safe than sorry", the product was also to be tested on the Oscillowitt-3, a sieve mill which alternates between rotating and oscillating and has a low circumferential speed which is suitable for gently grinding temperature-sensitive products. The team was also keen to bring the Hammerwitt, a hammer mill with a large milling force, on board, because it is extremely well-suited to milling free-flowing and hard products.

Laboratory test brings light into the darkness, at an ambient tem-

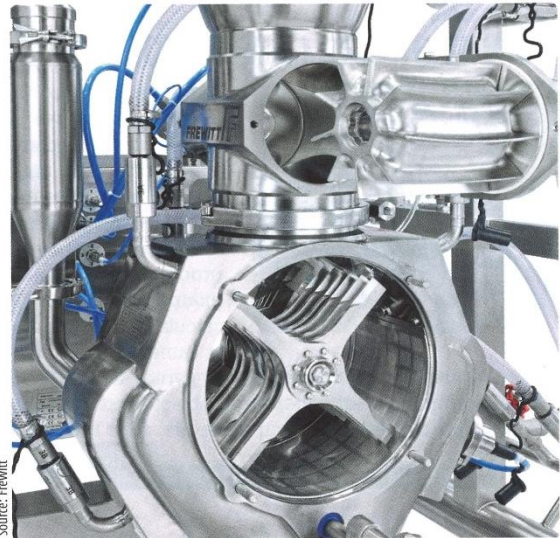
perature of 22°C and 58% humidity, the free-flowing and hard product was tested on the Coniwitt-150, Oscillowitt-3 and Hammerwitt-3 mills, and the results were evaluated on a Mastersizer 3000.

During test series one and two and the subsequent tests on the Coniwitt-150, the team needed to dig deep into their box of tricks to achieve anything close to the expected results. The tests with a rasp with 1 mm openings led to unsatisfactory results, both at a speed of 800 rpm and at a speed of 2,000 rpm. While 10.8 kg of the 12 kg of product in total were indeed ground in three minutes and 50 seconds at 2,000 rpm, the temperature rose to 34°C. For test series three to seven, the rotor arm was replaced, first by a rasp, and then by a special sieve with 0.5 mm openings. The results were similar to the first test series, except that the temperature only rose to 28°C at lower speeds. During each round, the product was too hard to pass through the sieve openings and ultimately heated up to 38°C at higher speeds, which was to be avoided. Conclusion: Further tests were required.

Next, it was the turn of the Oscillowitt-3: During the eighth test, a sieve with 0.71 mm openings and a circumferential speed of 1 m/s were used. For the ninth test, the Oscillowitt was switched from rotating to oscillating, and product was ground. Both tests revealed similar results: From a 5 kg batch, 2.9 kg of ground product passed through the sieve during the oscillating movement, but led to blockages due to the lower speeds.

Somehow, there was a hope that better results would be achieved with the Coniwitt-150, despite the insufficient outcomes. Test number 10 on the Coniwitt-150 with a different rotor arm and smaller sieve openings led to 2.4 kg of ground product out of a 5 kg batch passing through the sieve in two minutes and 20 seconds, which was also unsatisfactory.

Last but not least was the Hammerwitt-3, which was used for tests twelve and 13. At a speed of 3,500 rpm, during the first round 5 kg of product passed through the Conidur sieve in four minutes and



Source: Frewitt

25 seconds. The product temperature did not exceed 29°C during this process. During the second round, 25 kg passed through the same sieve at a throughput of 64 kg/h and a product temperature of less than 29°C, so the goal was achieved! The throughput, the temperature and, therefore, also the product properties were fully in line with the customer's specifications.

The final hurdle

During the tests, the Hammerwitt-3 was fed with a 5 kg batch first of all, and then a 25 kg batch. But on the customer's premises, the mill was supposed to be able to grind continuously, a requirement which was met using the Profi-Valve 80 dosing system, a frequency converter and a PLC. The system, equipped with retractable WIP nozzles, is easy to rinse once the grinding process is complete, and therefore quickly equipped for the next run.

Conclusion: The same number of product tests do not need to be performed for each product. However, if the product properties so require, it is certainly beneficial to know that the team at Frewitt will always be ready to lend an ear along with their wide range of mills and test lab fitted out with the latest equipment.

Tests performed, show that the Hammerwitt-3 the throughput, the temperature and the product properties were fully in line with the customer's specifications.

PROCESS-Tip

• Learn more about grinding technology in the Hot Topic **#Powder Bulk Handling** on process-worldwide.com