ENSURING OPTIMAL FLOUR QUALITY

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Millers in most parts of the world face many challenges, from price pressure to increased competition and stringent demands from flour purchasers.

Today's flour market is predominantly shaped by downstream processes, like industrial bakeries and pasta production.

These highly automated factories with streamlined processes need flour with consistent properties such as a specific particle size distribution and moisture content. Across different markets and geographies these requirements will differ but be no less precise. In addition, some also require flour for specialised end products.

At the same time as these requirements are becoming more precise, millers face the additional challenge that it is also becoming increasingly difficult to hire well-trained staff. This adds to the pressure modern mills find themselves under.

To meet these challenges, millers need to be able to rely on efficient processes that maintain a consistent quality output and meet specific requirements, a scenario that the Arrius integrated grinding system plays a key role in.

Improved starch damage management

Bühler's Arrius offers a multitude of new features including a solution for monitoring grinding force and the option to measure the temperature of the rollers. The newly developed roller configuration with pre-stressed rollerpacks achieves up to 10 percent higher starch damage, increasing water absorption and the availability of constituents for the enzymes required in the fermentation processes.

This is particularly relevant for bread making. Pre-stressing the rollerpack also ensures a precise grinding gap that remains stable over time. Double-sided sensors continuously measure the grinding force.

Taking a closer look at starch damage

Starch damage is one of the main parameters that determine the quality of flour. During the growth phase in the field, protein and starch are stored in the wheat kernel providing it with the nutrition it needs for its reproduction.

The starch granules within the endosperm are approximately the size of the diameter of a human hair – between 20 to 80 micrometers. During milling, the rollers can crack the shell of the kernels exposing the content and changing its chemical and physical properties.

We can't influence the protein content in the wheat kernel, but we can control and steer starch damage and consequently the quality of the end-product. Each market has its specific characteristics and requirements. The most successful players in the market will be the ones who keep tightly to consistency parameters.

Operators typically check samples of the product in the lab on a regular basis, as the setting of the rolls might shift slightly during operation. The Arrius is the first serial solution to this problem.

By measuring the grinding force on both sides of the rollers, it provides a clear indication of the status of the grinding work and consequently ensures that grinding performance remains stable throughout. In combination with the data on the flow rate, this enables millers to produce a consistent, high-quality product.

Adjusting starch damage and particle size distribution

In the process of grinding, the rollers apply two different forces on the grist: friction, as the two rollers rotate at different speed, and pressure. Overall, friction creates smaller particles, resulting in a finer flour, but does not break up the miniscule starch granules.

Grinding pressure on the other hand is strongly correlated to starch damage. When starch granules are damaged, it's like the raincoat has been taken off and water and enzymes can get in.

Different products and markets demand different grades of starch damage. Pasta and noodle production require low levels of starch damage as this results in less water needed to reach the right level of viscosity for the dough. Consequently, energy can be saved in the drying process.

A typical Japanese noodle producer demands a fine flour but little starch damage. Here the consistency of particle sizes also plays an important role. For other products higher levels of water absorption are required, which in turn need a higher degree of starch damage. These are typically products with shorter fermentation times, such as toast.

Achieving the correct particle size distribution on a consistent basis is key to the quality of the end product. Particle size distribution can change the overall amount of surface of the flour by a huge factor. It is essential to have full control over it," says Mr Dübendorfer. This way operators can ensure that the right amount of water consistently

reaches a defined surface area.

Fluctuations often take place unnoticed, compromising dough conditions and having a detrimental effect on efficiency in the downstream processes. The Arrius rollerpack achieves grinding results that are consistent in terms of particle size distribution too.

Understanding the importance of temperature control

Generally, a miller will always aim to avoid excess heat. Mechanical energy that is transformed into heat represents a loss. But heat also affects protein characteristics. Protein subjected to temperatures above ~ 42 degrees Celsius begins to react, coagulation starts and rheological behaviour changes.

With the built-in force sensors, the Arrius integrated grinding system provides a remarkable improvement, taking the grinding force as a fingerprint for what happens in the grinding gap.

With the temperature monitoring option, operators gain valuable information on the temperature distribution along the rollers. If the right end of a roller shows a different temperature than the left one, the grinding process will be quite different as well.

Counter reactions set in as the hotter part of the roller expands, causing temperatures to rise even further. Control over the process is lost and consistency of the product output impaired.

You want a consistent temperature at the lowest level. If you can keep the temperature at the same level, you have confirmation that consistency is maintained. The more information I get as a miller the better I can control the process and keep my product consistent.

Information on the grinding force and temperature distribution are great indicators on the status of the grinding gap. Additional digital services from Bühler provide accumulated data from sensors and machine parameters such as energy consumption."

Thanks to the integrated webserver all this data is accessible via a PC or via mobile devices, so that millers are no longer bound to the control room.

Essential information on process parameters is made available in the most user-friendly way. The Arrius offers millers precise control over each of these key parameters, but that is not all.

Arrius also offers other important benefits too, including energy saving, efficient use of space, quick installation and flexibility thanks to mobile control and management.

Energy saving

Compared to conventional belt drives the new integrated drive unit, consisting of the machine's motor and gearbox, allows for mechanical energy recovery saving up to 10 percent of the energy expended during the grinding process.

Efficient use of space

The Arrius relies on direct suction and an integrated drive unit and control cabinet which requires only one floor and can be installed flexibly in the plant, resulting in a significant reduction of building investment costs.

Quick installation

The retrofit with the Arrius can be undertaken with a minimum of time investment. A pilot retrofit installation and commissioning of 12 Arrius integrated grinding systems required less than a month of installation time from start to finish.

Flexibility thanks to mobile control and management

The Arrius can be operated via smartphone, tablet or on a PC located within the mill. In addition, the control system can be integrated into the Mercury MES (Manufacturing Execution System).

Consistency is king

The enhanced mechanical performance of the Arrius significantly contributes to the quest for consistent quality needed to succeed in today's demanding markets.

The improved monitoring and improved performance of starch damage represents a milestone in modern milling. In combination with the smart sensor technology, operators have in-depth information at their disposal ensuring excellence in process control.

Arrius truly changes the market's mantra, "consistency is king", from a challenge to an opportunity.