Online Quality Measurement in Corn Processing.

Maintaining high quality and increasing profitability.

Near Infrared Spectroscopy has been used in grain milling for many decades increasing food quality and profitability. Bühler's NIR Multi Online Analyzer (MYRG) provides continuous monitoring and analysis of the key attributes that determine the quality of a wide range of intermediate and final products. The key advantage: the proven technology delivers accurate information without delay and allows for immediate adjustment where necessary thus contributing significantly to a mill's bottom line. Recently the technology has been adopted by a growing number of corn mills, bringing these benefits to one of the most important crops in the global food industry.

In grain processing, timely and accurate quality control can make a significant difference to the bottom line. The characteristics of the raw material determine the price of the end product. As fluctuations can occur at any time in the process flow, spot checking is not a sufficient method to assure quality. For optimal results it is necessary to monitor the flow continuously.

Near-infrared spectroscopy (NIR) that utilizes the near-infrared range of the electromagnetic spectrum has been reliably in use in the grain processing industry to do this for decades, resulting in significant additional revenues for mill owners.

Bühler's NIR Multi Online Analyzer (MYRG) stands out for providing precise information on product quality in real time through continuous online testing via compact sensors that are easily retrofitted into existing plants. With its ability to measure several product parameters in parallel, the system has been adopted widely by wheat processors. But other grain processors too can benefit greatly from this technology – particularly those in the booming corn processing market.

Corn – not a run-of-the-mill product

Corn has long been an important food crop in many parts of the world. Today, its significance in the food value chain is growing. Since 1960 the global corn harvest has increased by 628% from 124 million metric tons to 903 million metric tons[1]. With 175 million tons currently consumed annually, corn is one of the three most important food crops in the world. It is processed into a wide range of food products the most typical being breakfast cereals, tortillas, extruded snacks and tortilla chips. Corn also plays an increasingly important role in animal feed and energy generation.

Corn consumption in Asian countries, such as Indonesia and India, is also on the increase. More than 20 million tons are consumed each year in Indonesia, where growth rates have been 70%. In India, consumption of corn-based cereals expected to grow at a CAGR of 18% by 2020. Global population growth and growing demand for gluten-free diets are likely to support these upward trends in many regions.

Hundreds of varieties of corn are grown in different regions of the world. It thrives wherever there are warm and humid conditions. The most important corn varieties are plata maize, grown especially in Argentina with round, hard and smaller grains, Yellow Corn, grown mainly in USA and Europe with yellow, semi/hard large grains and white maize, grown mainly in southern Africa with white, hard and large grains.

[1] Source: USDA, Foreign Agriculture Service, Production, Supply, and Distribution Database.

As the market for this diverse grain grows, there is an increased need for a quality monitoring system that can accurately and quickly detect changes in its various characteristic.

Corn products have different measurable attributes depending on the variety and final use. For example, the fat content of corn is approx. 3-4%, Corn Flaking Grits is <1% compared to >20% in Germ Flour. The particle size of Brewers Grits ranges between 1,200 and 300µm; whereas in Maize Meal it is with less than 355µm. As a result, entirely different production flows are designed with the finished product in mind. In contrast to wheat processing, the corn milling process diagrams vary much more depending on the country or region.

Multiple measuring points

Bühler's NIR Multi Online Analyzer (MYRG) meets all these challenges. In response to varying requirements for different end products different measuring points for Online NIR can be set. For corn flour, NIR measurement sensors are placed after cooling, monitoring moisture, contents of crude fat, crude fibre, polar starch and protein.

The sensors can be placed at various points in the corn mill. For raw material, sensors are positioned after pre-cleaning, to measure moisture, contents of crude fat and fibre, polar starch and protein, and thus ensure optimal storage control and overall quality control. At the other end of the process, the sensors measure the parameters of the finished product like flaking grits or maize flour as it arrives in the hopper scale. The direct online control in the mill allows for immediate correction of settings in the process should parameters differ from specifications.

	Corn		Corn grits		Corn flour	
	Range	SEP	Range	SEP	Range	SEP
Moisture	7 - 14.5 %	0.3 %	7 - 15 %	0.3 %	7 - 15 %db	0.3 %
Crude fat	0.2 - 16 %db	0.3 %	0.2 - 8 %db	0.3 %	0.2 - 16 %db	0.2 %
Protein	5 - 14 %db	0.4 %	5 - 14 %db	0.4 %	5 - 14 %db	0.3 %
Crude fiber			0.2 - 5 %db	0.3 %	0.2 - 5 %db	0.3 %
Starch			25 - 80 %db	3 %	25 - 80 %db	3 %

Table summarizing the individual parameters which can be measured

Bühler's newest generation of NIR spectrometers have been proven to achieve a remarkable level of accuracy. Comparison of the SEP values (Standard Error of Prediction) achieved by the NIR spectrometers with those from lab methods demonstrate that the system performs well in continuous production.

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