



Quality Control in a Flour Mill

APPLICATION BRIEF

The global flour market is projected to grow from approximately USD 173.5 billion in 2024 to USD 259.85 billion by 2033, reflecting a compound annual growth rate (CAGR) of 4.59%. Wheat flour remains the most widely used flour type, accounting for a significant share of the market due to its versatility in baked goods and other food products. Innovations in milling processes have improved efficiency and product quality, but as bakery brands expand their product lines to meet unique consumer tastes, mills must adopt more repeatable methods to meet the demand.

PROCESS CONTROL ANALYSIS POINTS IN A FLOUR MILL

There are multiple points in the flour processing procedure where accurate and timely analytical values can help control the process, saving money and improving yield:

- **Incoming wheat** can be analyzed for protein, and moisture. Wheat is traded based on protein and moisture content. Optimizing the raw ingredients to the final product will produce higher quality final products with higher yield and less re-work.
- **Blending individual bins of wheat** can help to obtain a target protein content. Analyzing the blend can confirm the composition of the wheat before the labor-intensive tempering and milling.
- **Tempering** processes introduce moisture to the wheat kernel to optimize the milling process. Ideally, the moisture is controlled within 0.5%. When wheat is at the optimal moisture, the milling process has a higher yield, uses less energy, and produces more consistent products and co-products.
- **In-process milling samples** can be analyzed for ash and protein content to determine yield or sieve effectiveness and optimize the yield or quality.
- **Blending flour** of a particular grade or characteristic such as protein or ash level is required to ensure quality and uniformity. Blended flours can be analyzed in-process to verify production and minimize rework.
- **Co-products** can be analyzed to determine value and quality for use as an ingredient. Protein, fiber, and moisture are typical constituents to measure.
- **Finished flour analysis** verifies the proper quality and grade.





SpectraStar™ XT Series NIR Analyzers, shown above, offer outstanding accuracy and reliability for rapid compositional analysis of solid, slurry, or liquid samples.

NIR ANALYSIS IN FLOUR MILLING

Historically, some of the first NIR analyzers used in flour mills were filter based instruments. These instruments use a small set of filters at set wavelengths to analyze samples and calculate the parameters of interest. This technology has stability and accuracy issues that limit its use for process control.

Based on a scanning monochromator, the SpectraStar™ XT NIR Analyzer Series is significantly more robust, accurate and reliable than the filter based instruments. The benefits and features chart illustrates why the SpectraStar is the best fit for at-line process control.

BENEFITS & FEATURES	FILTER NIR	SPECTRASTAR XT
Better accuracy and robustness with more data points	Up to 19	Over 1000
Easier to maintain with fewer calibrations	20 to 100	2-5
Enhanced stability with less frequent biasing	Daily	Quarterly
Increased confidence with outlier prediction warning	No	Yes
Stability against temperature, particle size, and humidity variation	Low	High
Suitable for process control	No	Yes

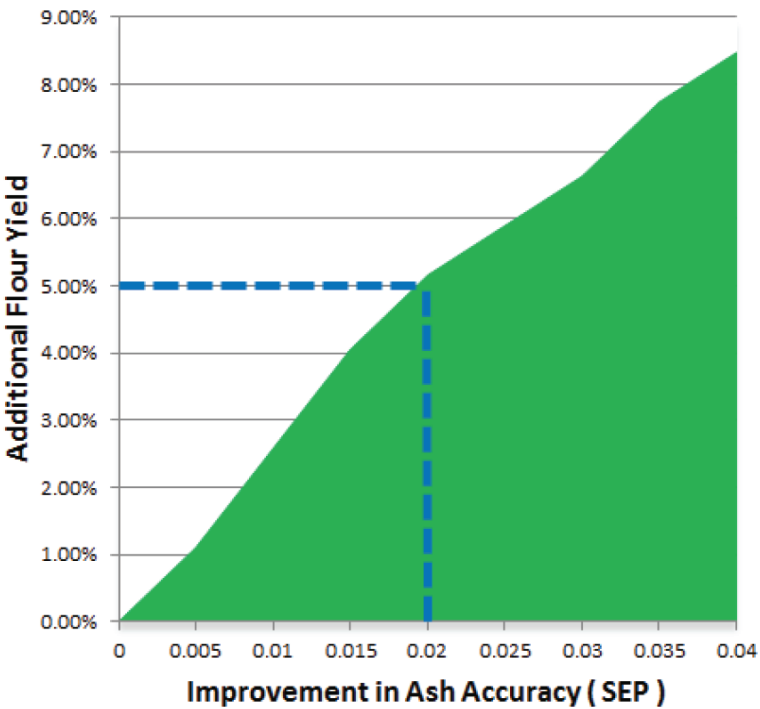
VALUE PROPOSITIONS FOR NIR IN CEREAL PLANTS

One of the most direct calculations to demonstrate the economic value of the SpectraStar XT analyzer is ash analysis. Ash content in finished flour indicates milling efficiency, with ash content increasing as more flour is extracted from the wheat. The closer a mill can be operated to the specified ash content, the more flour that can be produced.

The SpectraStar XT Analyzer produces extremely accurate ash values, allowing for much more precise control of the milling process. The chart at the left shows the additional flour yield that can be realized by using a SpectraStar XT compared to a method having an error of 0.03% (a best case scenario from other instrument types such as filter instruments).

At the typical ash error of 0.02%, the enhanced process control possible with the SpectraStar XT will result in an additional yield of approximately 5%. Based on yield alone, the typical payback time for an instrument in a medium sized flour mill is less than 6 months.

In addition to additional yield efficiency, significant savings are realized through reduced laboratory costs, less rework and improved moisture control.



ABOUT THE SPECTRASTAR™ XT SERIES NIR ANALYZER

KPM Analytics offers a variety of ready-to-use solutions tailored to the flour milling industry.

- Obtain vital quality parameter data in about 30 seconds, enabling quick response for quality control.
- Access an extensive library of robust calibrations developed from hundreds-to-thousands of samples. Calibration customization is also available.
- Minimal sample preparation, only minimal training required, and environmentally friendly.
- Available with KPMLink™, a cloud-based software suite to support the real-time remote configuration of product settings, calibrations, and more.



Ready-to-Use SpectraStar XT Calibrations for Flour & Milling			
SUBSTANCE	CONSTITUENTS	SAMPLING ACCESSORIES	PART NUMBER
Barley Whole Seed	Protein, Moisture, Starch, Fat, Ash, Fiber, Ca, P, Hoodness, Extract, Beta Glucan, Pentosan, IDF, SDF, TDF, NDF	US-LGOP-0001 Large Open Cup with plunger	APPS-CALB-174
Corn Seeds Expanded	Moisture, Protein, Fat, Fiber, Starch, Sugar, NDF, ADF, Ash, EFOS	US-LGOP-0001 Large Open Cup with plunger	APPS-CALB-182
Ground Wheat	Moisture, Protein, Fat, Fiber, Ash, Gluten, Vitreousity, Ca, P	US-LGOP-0001 Large Open Cup with plunger	APPS-CALB-151
Hard Wheat Flour	Moisture, Protein14M, Ash14M, Protein, Ash	US-LGOP-0001 Large Open Cup with plunger	APPS-CALB-013
Oat Flour	Moisture, Protein, Fat, Fiber, Ash	US-LGOP-0001 Large Open Cup with plunger	APPS-CALB-116
Pea Flour	Moisture, Protein (AS-IS), Protein (db)	US-LGOP-0001 Large Open Cup with plunger	APPS-CALB-086
Peanut Flour	Fat, Moisture	US-LGOP-0001 Large Open Cup with plunger	APPS-CALB-085
Rye Flour	Moisture, Ash, Protein	US-LGOP-0001 Large Open Cup with plunger	APPS-CALB-073
Rye Whole Seed	Moisture, Protein, Fat, Fiber, Ash, Calcium, Phosphorus	US-LGOP-0001 Large Open Cup with plunger	APPS-CALB-183
Soft Wheat Flour	Moisture, Protein14M, Ash14M, Protein, Ash	US-LGOP-0001 Large Open Cup with plunger	APPS-CALB-014
Soy Grits	Protein, Moisture	US-LGOP-0001 Large Open Cup with plunger	APPS-CALB-155
Spelt Flour	Ash, Moisture, Protein, Sedimentation, Water Absorption	US-LGOP-0001 Large Open Cup with plunger	APPS-CALB-142
Triticale Whole Seed	Moisture, Protein, Fat, Fiber Ash	US-LGOP-0001 Large Open Cup with plunger	APPS-CALB-026
Wheat - Ground	Moisture, Protein	US-LGOP-0001 Large Open Cup with plunger	US-CALB-132
Wheat Bran	Moisture, Protein, Fat, Fiber, Starch % OM, Starch % DM, Ash, Ca, P	US-LGOP-0001 Large Open Cup with plunger	APPS-CALB-068
Wheat Flour Clear	Moisture, Ash, Protein, Protein14M, Ash14M	US-LGOP-0001 Large Open Cup with plunger	APPS-CALB-011
Wheat Flour High-Protein	Protein, Ash, Moisture	US-LGOP-0001 Large Open Cup with plunger	APPS-CALB-140
Wheat Midds	Moisture, Protein, Fat, Fiber, Ash	US-LGOP-0001 Large Open Cup with plunger	US-CALB-135
Wheat Seeds	Moisture, Protein	US-LGOP-0001 Large Open Cup with plunger	US-CALB-133
Wheat Semolina	Moisture, Ash, Protein	US-LGOP-0001 Large Open Cup with plunger	APPS-CALB-143
Wheat Whole Seed	Moisture, Protein, Ash, Gluten, Fat, Fiber, Ca, P, Vitreousity	US-LGOP-0001 Large Open Cup with plunger	APPS-CALB-066
Whole Wheat Flour	Moisture, Ash, Protein	US-LGOP-0001 Large Open Cup with plunger	APPS-CALB-074
Wild Rye	DM, Protein, ADF, NDF, DDM, DMI, RFV	US-LGOP-0001 Large Open Cup with plunger	APPS-CALB-147
Yellow Corn Flour	Moisture, Fat, Protein, Ash	US-LGOP-0001 Large Open Cup with plunger	APPS-CALB-027

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