K-STATE Research and Extension

Innovations in Wheat Cleaning: Improving Process Efficiencies

Department of Grain Science MF3077 Wheat Tempering

Converting wheat into flour has three fundamental steps — wheat cleaning, wheat conditioning, and the milling process. All three steps affect the profitability and efficiency of a mill. The effect of the wheat cleaning process, as it affects flour quality and profitability, is commonly underestimated. Elements of the cleaning process that affect profitability include minimizing the loss of good-quality wheat into the screenings and the cost of operating and maintaining equipment in the cleaning process.

The production of high-quality flour begins with effective wheat cleaning. Critical flour quality characteristics, such as ash and color, are influenced by the cleanliness of the wheat delivered to the first break rolls. Consistency in the wheat tempering and conditioning process depends on effectively removing dust, foreign grains, and other impurities.

The flour milling industry continues to develop new technology to improve flour quality and consistency, maximize equipment use by reducing downtime, and improve energy efficiency. Recent advances in the process to remove impurities from good-quality wheat reflect the industry's desire to become more efficient at producing a consistent, quality product.

A Return to the Basics

Screening or sieving to separate good-quality wheat from foreign grains, sand, stones, and other types of course and fine impurities has traditionally been the principal cleaning method. Various machines, from gyratory sifters to oscillating screeners and many combinations, have been introduced and improved to increase sieving efficiencies. To improve sieving effectiveness, aspiration was incorporated into these designs to remove dust and light impurities before the screening .

Buhler's new grain classifier, VEGA, is used in flour mills to remove coarse and fine impurities from the grain by sieving. It combines traditional wheat sifting for size classification with modern engineering to produce a robust and efficient separator. With the ability to clean up to 200 metric tons per hour, the VEGA demonstrates the industry trend requiring a high-capacity grain cleaner that can fit into a small space. A distinctive feature that the VEGA reintroduces to the flour mill is the separating and grading of wheat for further processing. The sieve selection can be organized to separate the grain by size into two to four fractions. Wheat screening and sieving separators operate best when the grain first passes through an aspirator to remove dust and lightweight contaminants.

Advances in Color Sorting

The first application of color sorting in grain processing can be traced back to rice milling. Color sorting was first adopted in the wheat milling industry by durum processors looking for an effective method of removing ergot-contaminated wheat to produce a safer product. The first generation of color sorters was monochromatic, sorting grain based on shades of black and white. Advances in technology incorporated the use of high-resolution bichromatic cameras in addition to the standard monochromatic cameras for inspection in a wider color spectrum. This technology allowed the detection of more subtle defects and impurities.

Several companies are introducing innovative machines categorized as color or optical sorters that go beyond the optical separation of unwanted impurities by color. Recent advancements incorporate infrared and even ultraviolet sorting capabilities combined with color-detection technology to enable the inspection for foreign material with invisible optical properties, such as clear glass and stones.

Better light intensity, using fluorescent or halogen lighting contributes to more accurate separation of impurities from high-quality wheat. High-speed, reliable ejectors improve precision in the discharge and removal of defects and other impurities once they are detected. Better distribution and uniformity of the feeders that regulate the wheat flow into the machines have increased operating capacities.

These recent innovations have increased the capacity and productivity of optical sorters. Advances in technology have reduced the price per ton to purchase and operate this equipment, improving the cost effectiveness of optical sorters. The result is a much wider application of optical sorting in wheat milling. The ability to detect and separate on the basis of color, size, and shape with remarkable accuracy within a split second advances optical sorters as replacements for traditional disc and indent separators. Optical sorters

reduce the loss of good-quality wheat as compared to using mechanical shape separation. This improved precision, coupled with the higher cost of wheat, has increased the cost effectiveness of optical technology displacing traditional cleaners in new installations.

Applied Solutions

These individual advancements in wheat cleaning technology are irrelevant unless effectively incorporated into cleaning systems. The wheat cleaning process in modern flour milling focuses on more than a single machine. The changing characteristics of wheat from season to season at times require immediate adjustments. Identifying those factors is important to keep up with customer requirements and the increasing cost of wheat. Two challenges that are of continuous concern to millers are wheat kernel size and fusarium contamination.

Kernel size affects all classes and origin of wheat. Kernel size is affected by wheat type and growing conditions. As the cost of wheat increases, millers can blend wheat of different classes and origins to minimize costs and meet customer requirements. Blending wheat classes can create challenges in the wheat cleaning process by increasing the range of size and density of good-quality wheat. The application of optical sorting rather than mechanical sorting allows the mill operator to adjust the cleaning system to reduce the loss of good-quality wheat due to these subtle differences in size and density.

Fusarium contamination is most commonly associated with soft wheat or spring wheat, but it can affect all types of wheat. Fusarium cannot be removed from individual wheat kernels. It reduces the density of wheat, as well as giving the kernels a slightly pink tint. Innovations in optical sorting have effectively removed fusarium-affected wheat from good-quality wheat. This allows the miller to recover a portion of good-quality wheat from fusarium-contaminated wheat.

More traditional benefits of innovations in wheat cleaning include reduced energy consumption and lower maintenance costs. Reducing the number of moving parts in the wheat-cleaning system increases durability while reducing downtime and maintenance costs of cleaning wheat. Energy costs are reduced by consolidating multiple machines that use traditional mechanical methods of removing impurities based on size, shape, and density into one optical sorter.

Consistent performance, improved monitoring capabilities, and more precise removal of impurities minimizes loss of good-quality wheat during the cleaning process. Minimized loss equates to maximizing extraction and flour yields, improving profitability.

Applying these innovations to the cleaning process produces a safer, more consistent finished product. Improving product purity and food safety standards enhances the profitability and image of the milling industry.

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