

New installation

Automated system streamlines corn flour production

A corn flour producer automates its processing lines to improve production efficiency and reduce labor requirements.

Corn Flour Producers (CFP) LLC, Worthington, Ind., mills locally grown yellow and white corn into corn flour that's used by tortilla producers and other Hispanic food companies for making tortillas, taco shells, corn chips, and other products. Founded in 2004, the company purchased an existing facility to produce the corn flour. CFP's general manager is Leonardo Olavarrieta, and he has more than 25 years experience in the corn flour industry. He says that to make the facility as efficient as possible, he worked with an integrated systems supplier to design and implement a completely automated production process.

Producing corn flour

The corn is delivered by truck to the facility's receiving area, and the yellow and white corn kernels are separated and conveyed into dedicated storage silos. To make a flour product, the required corn is transferred from the silos to a screening and cleaning operation, where it's sized, washed,

and dried and then conveyed into a holding silo before being moved into the process. Depending on the flour recipe, either 100 percent white corn, 100 percent yellow corn, or a blend of the two is transferred to a nixtamalization process where the corn is cooked in a lime-water solution to remove the germ and hard outer hull from the kernels, making it easier to process into flour.

The corn, now called nixtamal, is transferred to a tempering bin before being metered into a hammermill for milling. The milled material discharges from the hammermill and is conveyed through a series of cyclones that use heated air to dry it. From the cyclones, the dried material is sent through a series of screening, grinding, sifting, and aspiration steps in which it's milled and sized to the corn flour grade's required particle size and consistency. The corn flour is then conveyed to a storage silo before being transferred into PD trucks or collection bins before being packaged in sacks or bulk bags for delivery.



An operator controls the corn flour production process using a color touchscreen operator interface installed in a central control room that overlooks the facility's processing lines.

According to Olavarrieta, operating a corn processing facility without an automated system can be labor-intensive. “You typically have two operators who receive the trucks, load the corn into the storage silos, and operate the corn-cleaning process,” he says. “And then you have an operator who manually adjusts the feeder that feeds lime into the water used for boiling the corn. This operator also manually monitors and maintains the boiler’s water temperature.

“You also have two laborers who monitor the milling process to ensure that the milling and screening equipment functions properly during operation. If any other equipment in a

process line needs to be adjusted, an operator has to walk out into the facility to change the equipment setting, which takes time, slows production, and affects the consistency of the final product.”

When designing the new facility’s production process, the company’s priorities were to reduce labor costs, maximize production efficiency, and increase quality control. To achieve these goals, several design challenges had to be overcome, including conveying moist nixtamal and dry corn flour at rates up to 22,000 lb/h and distances greater than 300 feet horizontally and 50 feet vertically; minimizing kernel breakage and product degradation



The automated control system remotely actuates a storage silo’s diverter valve to direct the corn kernels to the appropriate processing line.

throughout the production process; and removing any dust, fines, and unusable material from the process for subsequent use as animal feed.

Improving the production process

Shortly after the company was formed, Olavarrieta contacted an integrated systems supplier he had worked with many times over the years. K-Tron Premier (formerly Premier Pneumatics), a member of the K-Tron Process Group, supplies custom vacuum and pressure pneumatic conveying systems, various material handling and processing systems and equipment, and complete systems engineering and integration services for the food, pharmaceutical, chemical, mineral, and plastics industries.

“When we were looking to automate the corn flour production process, I didn’t think twice about calling the supplier, because I already knew about their systems integration capabilities,” says Olavarrieta. “Over several months, we worked together designing the process lines and control system—I designed the process lines and equipment layout, and the supplier designed the automated control system to run the process lines. The supplier’s technicians traveled to the facility several times to ensure that the control system was properly integrated with all of the process equipment.”

Olavarrieta sent some product to the supplier’s facility in Salina, Kans., to establish operating parameters for the conveyors and feeders that would prevent product degradation during production. “The supplier also made a test control panel that simulated the actual corn flour production process, so we could test all of the variables before installing the control system,” he says. “I visited their facility a couple of times to test the system and learn how to use it. The tests were very useful because they showed us we were going to get the results we were looking for *before* we installed the equipment and control system in the facility.”

In early summer 2005, the company hired a local contractor to install the production equipment and control system. After this, the supplier’s electrical and mechanical technicians traveled to the facility to verify that the equipment was correctly installed and connected to the control system’s control panel. In spring 2006, the company started up the process lines and began producing corn flour.

The automated system

The supplier provided an automated material handling system capable of producing CFP’s various grades of white, yellow, and blended corn flours. The control system that operates the facility’s processing lines consists of an Allen-Bradley PLC and a color touchscreen operator interface with graphics that shows all of the processing lines’ equipment controls and settings. To change an equipment setting, an operator simply accesses the touchscreen, specifies the equipment, and changes the setting, such as the conveying rate, feedrate, or water temperature. The system’s feedback loop shows the operator the setting changes as they occur.

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“Using the control system is much more efficient than doing things manually because you don’t have to walk out to the equipment, make the change, and then wait to see what it does, which can take time,” says Grant Nurnberg, K-Tron Premier global controls engineering manager. “The control system is installed in an air-conditioned control room with a big window that overlooks the facil-

ity, and the operator controls every aspect of the production operation from there using one touchscreen.”

During each production run, the control system logs the equipment operating parameters, allowing the company to select a time range and export the data to a spread sheet. This trend data helps maintain quality control since the company can review a production run’s operating conditions and fix any problems in future runs should something go wrong. The control system also keeps track of the yellow and white corn use and saves the information to a database, allowing an operator to easily monitor corn usage rates via the touchscreen. In addition, should a piece of equipment ever malfunction, the control system will sound an alarm to alert the operator to fix the problem. If a major malfunction occurs, such as a dryer getting too hot, the system will sound an alarm and initiate a controlled shutdown sequence to stop the process line’s operation.

Making the production process more efficient

Since automating the corn flour production process, the company has reduced the labor required to operate the process lines. “Because we can monitor and control all the equipment remotely, we’ve been able to reduce labor by one operator and two laborers per shift,” says Olavarrieta. “We can control the entire production process from the control room with just two operators per shift using the touchscreen interface. And since it takes less time to change equipment settings, we’ve improved the operation’s efficiency and are able to produce about twenty percent more flour than we could have doing things manually. We’re also producing a more consistent final product since we have better control over the process. Based on what I’ve done before in the corn flour processing industry and what I’m doing now, the automated system makes a big difference.”

The company is more than satisfied with the service the supplier provided throughout the project. "We've always had the support we need from them, from designing the automated control system to starting up the process lines," says Olavarrieta. "The supplier's after-sale service has also been great; I can order parts one day and get them the next. And if something goes wrong with the process lines that we can't fix, we can call the supplier and they can check and fix the system remotely through a modem, which helps keep production going. They also provide assistance for special projects, like when their local sales rep helped us add equipment to a process line. In fact, because we're going to be operating at full capacity soon, we're planning to expand the production operation, and the supplier is going to be our first choice for that project."

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