'Bending' equipment for food quality and safety

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Food processing companies are determined to have unique equipment designs that meet the safety and food quality needs of their products

By Ed Sullivan

Meat processors such as Butterball reveal that a cooperative engineering effort and 3D modelling 'bends' the process to the exacting requirements of the final product.

Producers of ready-to-eat meat and poultry are incorporating infrared (IR) food processing technologies to ensure food safety as well as optimising colour, taste and cooking efficiencies.

IR pasteurisation equipment is bolstering efforts to combat the hazards of Listeria and other pathogens on products ranging from hams and briskets to deli loaves. The use of quick IR surface treatment of such pre-cooked products can provide a log reduction of three or better. By combining short, medium and long wave high-response IR emitters, a process can be fine-tuned to maximise product safety while also achieving the required surface finish, including colour and texture of meats as well as topping products such as cheese.

Yet, too often, such equipment is only available "off the shelf" and isn't readily adaptable to the existing process. As a result, food processors find that the end product has to adapt to the limitations of the equipment and this can affect the colour, texture, flavour, processing time, throughput, and safety (along with other factors).

Fortunately, there is an alternative. Major food processors such as Butterball are now determined to "bend" the equipment to meet the exacting safety and food quality needs of the product through a new paradigm: cooperative engineering and innovative 3D modelling with the

equipment manufacturer to streamline and improve the process.

At Butterball LLC, IR pasteurisation was recently added to the lines at the Jonesboro, AR and Longmont, CO plants. Both 3D design and equipment customisation were major contributors to the success of this project.

"Although we were primarily interested in the food safety benefits of IR pasteurisation as well as protecting our brand, we also felt there was an opportunity to optimise the equipment in terms of human safety and ease of maintenance," says Steve Valesko, Butterball Vice President of Engineering. "We also sought to incorporate automation features that would monitor equipment status and notify the operator if the IR pasteuriser was approaching a need of service."

The trial run – standard equipment

Valesko, a long-time veteran of the industry, says that although he anticipated the need to customise the new IR equipment to Butterball's specification, the engineering and production groups began the move to the new pasteurisation equipment by trying standard equipment offered by Unitherm Food Systems (Bristow, OK).

"They're a major supplier of equipment to our industry, and we were assured that they would work with us to tailor the new equipment to meet our requirements," Valesko says, "so we felt that 'test-driving' the standard equipment would both facilitate and expedite that process."

Unitherm is recognised for its abilities to meet regulatory as well as engineering requirements, and its capabilities in customising equipment. The firm describes this as 'bending' the design of its cooking and chilling equipment to ensure an optimum fit with the advanced features wanted on the production lines of many of the food industry's biggest players.

"There's a tremendous need in the food processing industry to have access to customised equipment," explains David Howard, Unitherm CEO. "For instance, there is certainly a selection of standard IR equipment available, but in order to get the results needed for food preparation safety and other features, it's usually a good idea to engineer the equipment to best fit the customer's needs and provide the highest quality and yield of products."

"That demands a cooperative engineering effort where feedback can be turned into appropriate and beneficial design modifications that meet the needs of the end product," adds Howard.

"We ran the initial equipment for about a month," Valesko says. "Although it was quite evident that we would need to make alterations to our final IR pasteurisation equipment design, that trial period with the off-the-shelf equipment was highly beneficial. It permitted us to see the equipment in action and redesign it with Unitherm to meet the needs of both our process and our products."

The preliminary trials, held at Butterball's Jonesboro plant, entailed full production runs, checking product temperatures and ensuring that the IR pasteurisation performed the proper amount of log reduction of food-borne bacteria.

"Our basic concern was to ensure the wholesomeness of our product," Valesko says, "which entailed the necessary protection of our deli products prior to sealing in the bag."

He adds that some of Butterball's deli customers, including major supermarket chains, have begun to request IR pasteurisation as an assurance of safety for the meat and poultry products that they slice and sell.

3D for validation and further improvement

After the trial run, Butterball engineers and process people decided on several upgrades for the IR pasteurising equipment, either to meet their food safety goals or to better integrate with the process.

"What we didn't want was to change the way the equipment operated," Valesko explains. "Yet, there were specific alterations that we knew would make the system much better for our operations."

Most of the alterations Butterball requested were aimed at improving human safety and ease of maintenance. They specified a change in the way the equipment hood opens and closes, so that it's more user friendly. The outside of trial pasteuriser would get hot, so Butterball stipulated that it be made cool to the touch. The Butterball project team also requested that the belt could be cleaned more easily.

The key to making those changes was the collaborative effort between the equipment design engineers along with Butterball's engineers and process managers. Among the most noteworthy tools to facilitate that collaboration was a 3D modelling program that Unitherm uses so that every nut and bolt of a system can be portrayed, reviewed and approved (or further modified).

"The 3D modelling was one of the beautiful parts of this project," Valesko explains. "It allowed us to see exactly what the machine was going to look like. And from highly detailed 3D images, we were able to make further alterations, including structural changes to the frame of the machine."

Valesko adds that the 3D illustrations helped Unitherm to cooperate fully in adapting or bending its equipment design to meet Butterball's production and quality requirements.

"We worked very well together on the project," he says. Now, we feel assured that the

equipment has been designed to accomplish what we've set out to do."

He says that although Butterball was responsible for the redesign of the IR pasteurisation system, nothing about the final concept is considered proprietary.

"The improvements that we made had to do with food safety and human safety issues. Those are concerns that are shared by the entire industry," Valesko says. "So, for the betterment of the industry, we're willing to share information about our own improvements in those areas."

3D design helps IR cook

Other IR-based cooking applications, gas infrared ovens, also benefit from the highly interactive process of 3D design.

Replacing the popular impingement and spiral ovens, gas IR is quickly becoming the gold standard of control of colour, shape and moisture of ready-to-eat foods such as the breakfast sausages served by fast food restaurants.

Lopez Foods, which supplies breakfast sausages to McDonald's, decided in 2007 to upgrade its seven sausage lines to improve efficiency and save on energy while ensuring product quality.

By using 3D modelling, Unitherm was able to work hand in hand with the food producer and refine the design to eliminate daily operational concerns that affected the lines.

"We redesigned the extraction hood system to reduce cleaning time by 84%," explains David Howard, Unitherm CEO. "With our customer's input, we designed the water flow system and transfer decks to eliminate charring on the stainless steel surfaces. This also reduced cleaning time. But the biggest obstacle was developing a new emitter that had no reliance on ceramics."

As a measure of the 3D modelling approach, as well as a commitment to innovation, Unitherm developed a cast burner head featuring a stainless steel sponge material that could be used to create the infrared emitter.

"The success of this head took the fragility out of the line, making it 1,000-fold more reliable," Howard says.

Howard adds that, until recently, equipment manufacturers were putting 2D drawings in front of their customers' engineers. Because those drawings were flat and a challenge to read, it was difficult to visualise what the finished equipment was really going to look like.

"The 3D model shows engineers and other members of a development team a fully designed piece of equipment that they can interact with," Howard says. "This enables them to become

part of the process, and the functionality enables them to provide us with an end-user point of view.
Although we're experts at developing equipment and systems, there may be some aspects of equipment design that can be improved by the user; the personnel who work with the machine every day."

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