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Inventor Looks Beyond Steam As An Energy Source In Food Processing

Lower capitalization and operating costs are magnetic induction's pluses, but changing mindsets is an uphill fight.

By Kevin T. Higgins, Managing Editor

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Invention is one of the needs food companies increasingly are outsourcing, often to people who previously tackled the job while on the payroll. Product development is a current example, with hundreds of R&D professionals exchanging their keycards for subcontractor status.

Technology development already has been relegated to non-core competency status. Few companies still have research scientists on staff. Instead, those specialists work independently to build better mousetraps, then try to convince their erstwhile employers to use them.

Food chemist George Sadler is part of the outside inventor community. The former professor of food chemistry and packaging at the Illinois Institute of Technology and researcher at the National Center for Food Safety and Technology (now the Institute for Food Safety and Health) in suburban Chicago set up Prove It LLC, an independent lab in Geneva, Ill., in 2006. Among the development projects he's worked on since is a heat exchanger using magnetic induction instead of steam as the energy source.

A U.S. patent was issued in 2009, though moving the system beyond the lab and into industrial application is a more daunting challenge than design engineering. Recently, Sadler teamed up with Francesco Aimone to advance the technology's commercialization. The two established Induction Food Systems (www.inductionfoodsystems.com) for that task. Sadler is chief technology officer, the same title he holds with Prove It, while Aimone serves as CEO.

Electromagnetic heating takes square aim at steam as an energy source in many food processes. As a heat transfer medium, steam is relatively efficient, though the attendant boilers and infrastructure adds capital cost, complexity and inefficiencies. Industry traditionally turned to former naval technicians to operate and optimize steam systems, but the U.S. Navy hasn't commissioned a steam-powered vessel since 1979. Absent the talent pool of yore, manufacturers are forced to either recruit and train personnel with competencies no longer considered core or accept that energy as a unit cost is higher than they think it is or could be.

Whereas conventional heat exchangers rely on conduction to transfer thermal energy from steam to food, Sadler's tube-in-shell system relies on induction. Viscous food flows through the shell, where it is in contact with a bundle of

metal tubes that cause turbulence flow for greater heat-transfer efficiency. Electricity causes resonance of the tube's magnetic field, exciting electrons to generate heat to thermally treat from the inside out.

Precise temperature control was one of the challenges he had to overcome. Sadler is confident the system can hold a set point "within 0.5°C, assuming you have a good operating person, and even 0.1°C is realistic." Another advantage over steam is quick come-up: While a steam-powered system might take two minutes to reach the set-point temperature, magnetic heat induction reaches it in five seconds, according to Aimone.

As a result, 95 percent of the energy input is applied to the food, compared to 20 percent for steam systems. Boilers and other steam-system components are rendered obsolete.

A better mousetrap isn't any good without someone trying to get rid of a mouse. Working with companies building new plants or upgrading standard equipment is Aimone's job. The first step is educating architectural engineers about the technology and how it can benefit their food clients. Besides reducing energy costs, consistent heat transfer can sterilize food at a lower temperature, improving the quality and nutritional content of finished goods.

One of the first industrial applications likely will be in clean-in-place: Aimone is working with a New Zealand firm that would like to incorporate a 20 kW system in a mobile CIP unit with a 40-gal. tank. A 10 kW pilot unit currently resides in Sadler's lab. Its flow rate is a meager half-gallon per minute and relies on 480-volt triple-phase power.

Sadler believes a skid-mounted system would be attractive to the hundreds of entrepreneurs entering the craft beer business every year. A steam system may be too costly for those brewers, but magnetic induction could be their ticket to consistent brewing at a lower cost. "They're not investing in production yet, and yet is the operative word," chimes in Aimone. "When they're ready to scale up, this technology will make sense."

Business challenges dwarf the technology's technical challenges. Grants from USDA, NASA and other sources have sustained IFS to date, and the company likely will enter its angel funding phase later this year. Energy efficiency, the potential for higher quality products and lower capitalization costs are compelling arguments; to be winning arguments, magnetic induction will have to overcome inertia against change.

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