

THE BENEFITS OF HIGH PRESSURE PROCESSING



THE NATIONAL
PROVISIONER
THE AUTHORITY ON THE BUSINESS OF MEAT AND POULTRY PROCESSING

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EDITOR'S NOTE

BY ANDY HANACEK, EDITOR-IN-CHIEF, *THE NATIONAL PROVISIONER*

Food safety: It's what keeps processors up at night, nearly every night. We know it here at *The National Provisioner*, because it's the top concern listed any time we survey our readers — the top meat, poultry and seafood processors in North America. Numerous interventions and hurdles have been developed and instituted by processors. One of the most promising yet, high pressure processing (HPP), has quickly become an option to improve the safety of many different types of food products.

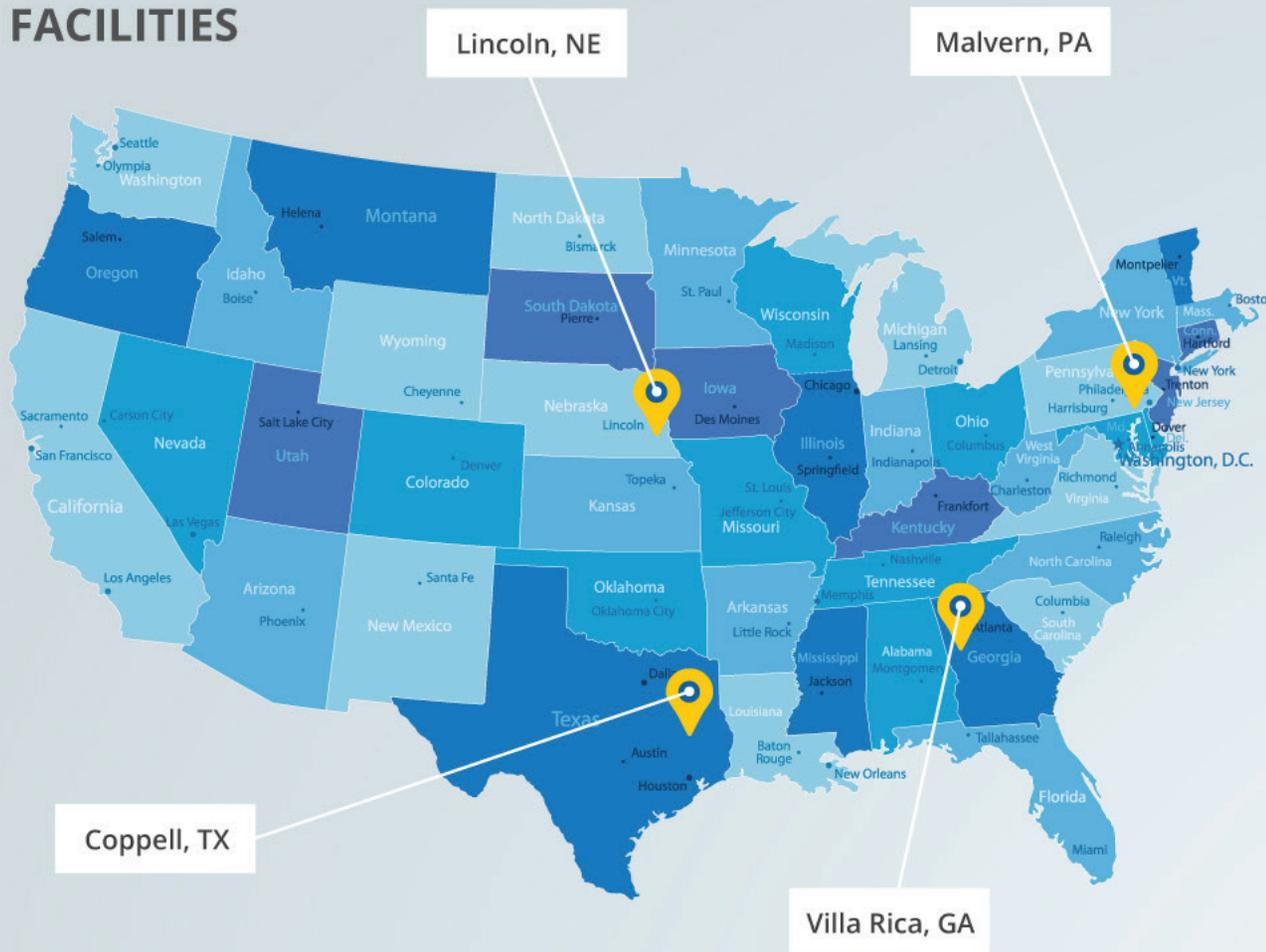
Yet, food safety isn't the only thing HPP improves. As you've read in the pages of NP in the past, and will read in the following pages of this eBook, processors who adopt HPP reap benefits for their products in a variety of ways. If you're considering using HPP on your products, we hope this eBook helps you better understand the technology and possible fit for your product lines.

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CHANGES IN GLOBAL DEMAND DRIVE INNOVATIVE TECHNOLOGY, SERVICE

Given the significant changes happening on a global level, there's never been a more interesting time to be in the food industry than today, whether you're a manufacturer, service provider or consumer of food. Universal Pure — the largest HPP outsourcing service provider — accepts and embraces the leadership responsibility to serve the food and beverage industries with the benefits of high pressure processing (HPP) during these changing times. HPP is a relevant and purposeful technology, offering processors improved food safety, cleaner labels, reduced food waste, higher quality and great taste for their products. At Universal, we pride ourselves on understanding and fulfilling the varying HPP needs of food and beverage manufacturers.

We are especially grateful for the opportunity to support manufacturers' innovation efforts with

"Universal stands by its uncompromising dedication to help ensure the safety and quality of your foods and beverages — it is our greater cause."

- Mark Duffy, CEO, Universal Pure

their new product development. Additionally, HPP is an excellent support technology as more and more companies bring fresh, natural, organic and cleaner-label products to market. The fresh trends in foodservice and the continued strong growth in retailer sales in the perimeter of the store are enabled and supported by HPP technology.

Outsourcing your HPP needs and services is our expertise, and we are uniquely advantaged as your one-stop shop for pre-HPP and post-HPP value-added services:

- We are the largest HPP outsourcing service provider, with four locations and 10 operating HPP machines.
- We leverage our technical, quality assurance, engineering and cold-chain expertise to support your business.
- Every Universal location has various cold storage and related services (i.e., kitting, pre-pricing and code dating, inventory control).

Outsourcing your HPP needs allows for: production planning efficiency and flexibility; redundancy and business continuity; capital avoidance; and operational HPP expertise.

Universal stands by its uncompromising dedication to help ensure the safety and quality of your foods and beverages — it is our greater cause. We welcome the opportunity to serve you, your partners and your consumers.



With gratitude,
Mark A. Duffy
Chief Executive Officer
Universal Pure

HOW PRESSURE PROPELS THE CLEANER-LABEL FOOD MOVEMENT

Time and pressure. When at their best, they turn charcoal into diamond, sand into pearl.

And if you're among a growing list of manufacturers of foods that contain high levels of water activity and low amounts of air — e.g., poultry, seafood, marinated beef, ready-to-eat meals, dips, spreads, dressings, sauces, juices, flavored water or raw pet food — the combination of time and pressure, harnessed by state-of-the-art technology, may be protecting your consumers, your brand and its bottom line, and your product integrity.

Named last year the No. 1 most important food technology in both North America and Europe for the next 10 years, high pressure processing (HPP) ironically isn't really processing at all. Indeed, rather than sterilizing food through (oftentimes white-hot) thermal pasteurization or irradiation, HPP harnesses the power of pressure to comprehensively inactivate illness-

causing, vegetative pathogens (*E. coli*, *Salmonella*, *Listeria monocytogenes*, etc.), molds and yeasts without compromising the nutritional value of the food.

"Global sales of clean-label food and beverage products may reach \$180 billion by 2020..."

- Ewa Hudson, global head of health and wellness, nutrition and ethical labels, Euromonitor

Of course, we're not talking just any pressure. We're talking immense isostatic pressure. Picture water, pressurized to as much as 87,000 psi — five times stronger than that found at the bottom of the ocean — suddenly exerting equal force on every contour of foods already sealed in their packages. At the molecular level, HPP subjects food to a sort of hydrostatic stasis, constrained in place while the

cellular function of any pathogenic and spoilage organisms is irreparably disrupted. All of this occurring in the product's finished packaging — which allows zero opportunity for contamination.

After holding product in that pressurized state for one to six minutes, the powerful electric pump releases its grip on the product with little to no outward changes in terms of appearance, texture or taste. On the inside, however, the bad bugs have been rendered ineffective and left to die. (Both the USDA/FSIS and FDA recognize HPP as a legitimate lethality step, and many producers have incorporated HPP as a preventative measure in their HACCP plans.) This activity also disarms shelf-life-limiting spoilage organisms (fungi like yeast and mold) that allows HPP-treated food to feature, on average, at least twice the shelf life of products undergoing other treatments — meaning more time to travel through the supply chain and to be purchased and enjoyed by consumers.

“For Subway, the primary focus for using HPP was the cleaner label, an initiative we started four years ago.”

- Rick Buttner, director of quality and supply chain risk, IPC

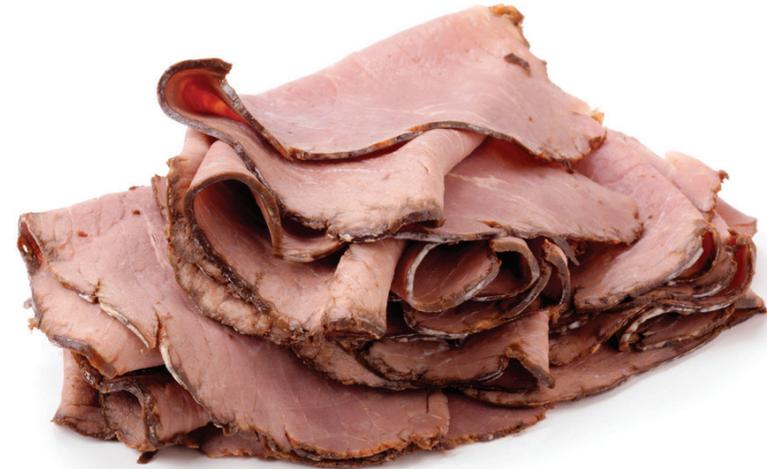
THE CLEAN CLINCHER

The impact of simultaneously enhancing food safety, dramatically reducing food waste and bolstering bottom-line profits through HPP is nothing short of profound. Yet as fantastic as the food safety and food waste benefits are for this game-changing, non-thermal preservation method, for many processors, the clincher comes from HPP's ability to produce “cleaner-label” products with maintained nutrients, unaltered proteins, natural flavors and minimal sodium levels. While HPP is not the solution for every type of food — or package type, for that matter — the technology has emerged

as the choice of many processors looking to differentiate their products with more natural and better-for-you qualities.

The cleaner-label trend presents a huge opportunity for producers of all sorts of refrigerated, frozen and other foods, with North America alone generating \$62 billion in cleaner-label food and beverage in 2015, according to Euromonitor. This seismic shift in consumer preferences is enabling a food revolution. From antibiotic-free meats and poultry to the phosphate-free marinades that cover them, more than 20 percent of new U.S. products reportedly now feature a cleaner label. No doubt, that percentage is growing, fueled by a “back to basics” demand for purer ingredients and simplified processing. Major industry initiatives are underway to limit artificial coloring and flavorings, reduce added sugars, switch to GMO-free ingredients and reduce routine antibiotics given to animals.

In terms of processing, thermal methods, traditionally used for food preservation, carry disadvantages including the destruction of vitamins and useful



bioactive compounds, and change in natural flavor that can be avoided with HPP. In addition, the preservatives often added to heat-pasteurized products are bacteriocins intended to inhibit pathogenic growth rather than kill the pathogens.

FROM INTERNAL METHOD TO R&D GOLD

At the 2016 HPP Summit hosted by Universal Pure in October, Rick Buttner, director of quality and supply chain risk for IPC, noted how HPP has begun to evolve from an internal method to a

consumer-facing and new-product innovation issue. IPC serves as the purchasing cooperative for Subway Restaurants, which now uses HPP on all deli meats sold in its sandwiches nationwide.

“For Subway, the primary focus for using HPP was the cleaner label, an initiative we started four years ago,” Buttner explained. “We were also able to take one of our frozen core proteins — roast beef — and transition it to fresh and really improve the quality of the meat. Then we started to ask ourselves, ‘How do we really talk about it to the consumer?’ I think the only way is through cleaner label.”

Buttner added that the R&D group had just begun getting involved with HPP at the time of the 2016 HPP Summit, and the results to that point had been positive.

“They’re starting to see that there are other applications other than what we’re doing now on the protein side, and I think they’re looking for ways to play around with it in other categories — wet salads, sauces and more,” he said. “I’m excited because I think they’re going to take the torch and be pushing it from the R&D side.”

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It is clear to Buttner and hundreds of other food scientists and strategists that the true impact of HPP is far from being fully realized, and that we’re merely in the middle innings of a much bigger game of generational change in food.

¹ Jermann, C. et al. “Mapping trends in novel and emerging food processing technologies around the world.” *Innovative Food Science and Emerging Technologies*. 2015;06(007) <http://www.sciencedirect.com/science/article/pii/S1466856415001162>.

SURVEY SAYS ... NEW STUDY REVEALS GROWING ENTHUSIASM FOR HIGH PRESSURE PROCESSING

For manufacturers of high pressure processing (HPP) technologies and the network of HPP service providers that regularly uses their vessels to assist food brands, the dramatic growth of HPP is unmistakable.

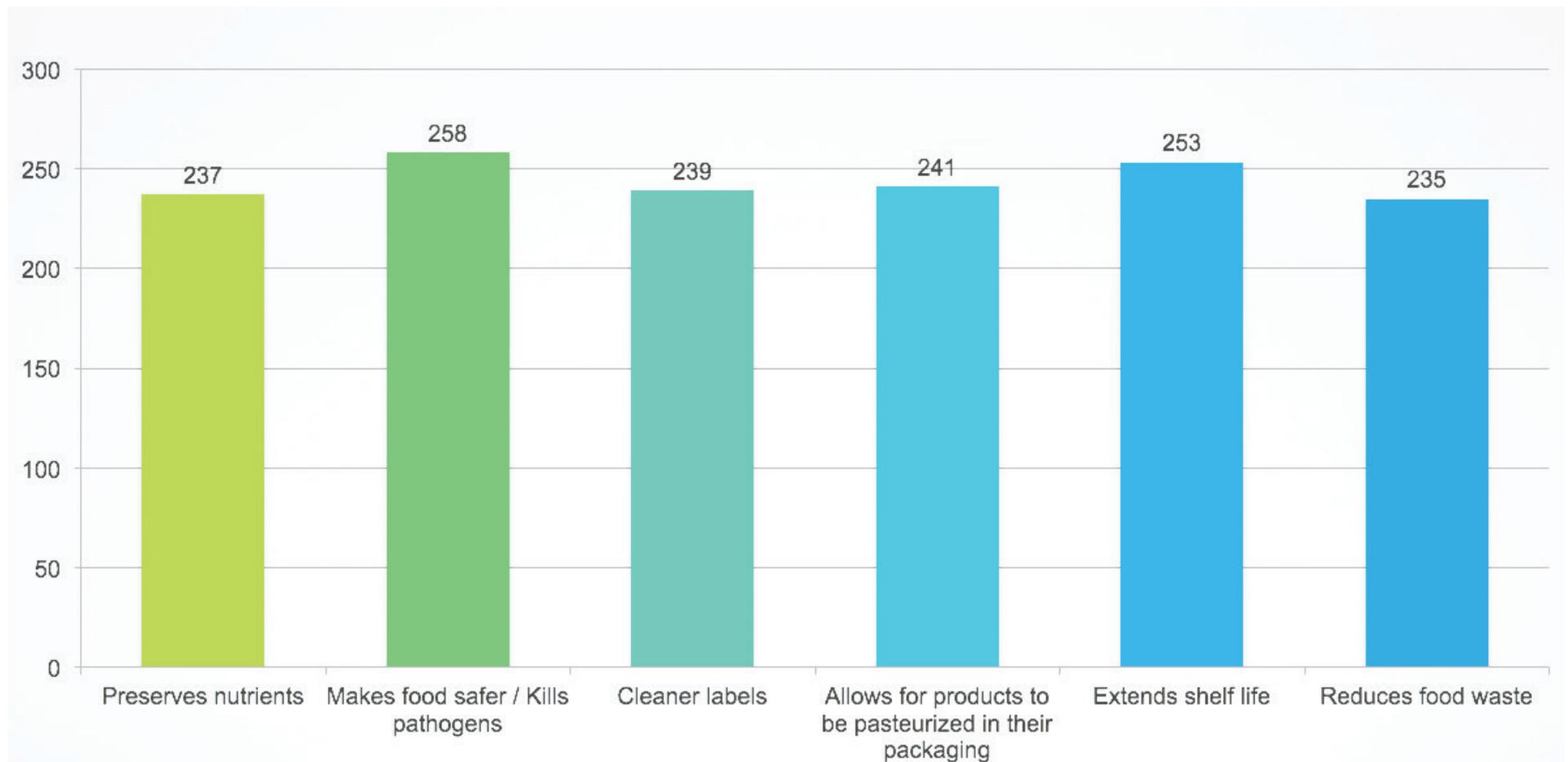
The trend certainly has not escaped industry analysts, who estimate that the combined market for HPP products has grown exponentially to \$11 billion and will soon surge to \$20 billion. And retailers find themselves stocking their shelves more and more with a wide array of HPP products — everything from ground turkey to guacamole, deli meats to tuna salad.

However, with multiple ways to produce safe food (guided by the USDA, FDA and other regulatory agencies) and prolong product shelf life, how do the people who produce meat, poultry, fish, and other refrigerated and frozen food products feel about the technology?



Seeking to identify perceptions about HPP in comparison with other food treatment methods, a fall 2016 survey commissioned by Universal Pure gathered measurable data (perhaps for the first time) on such issues from industry insiders. Respondents indicated growing appreciation for HPP's role in preserving nutrients and food quality while making food safer,

TOP-RANKED BENEFITS OF HIGH PRESSURE PROCESSING



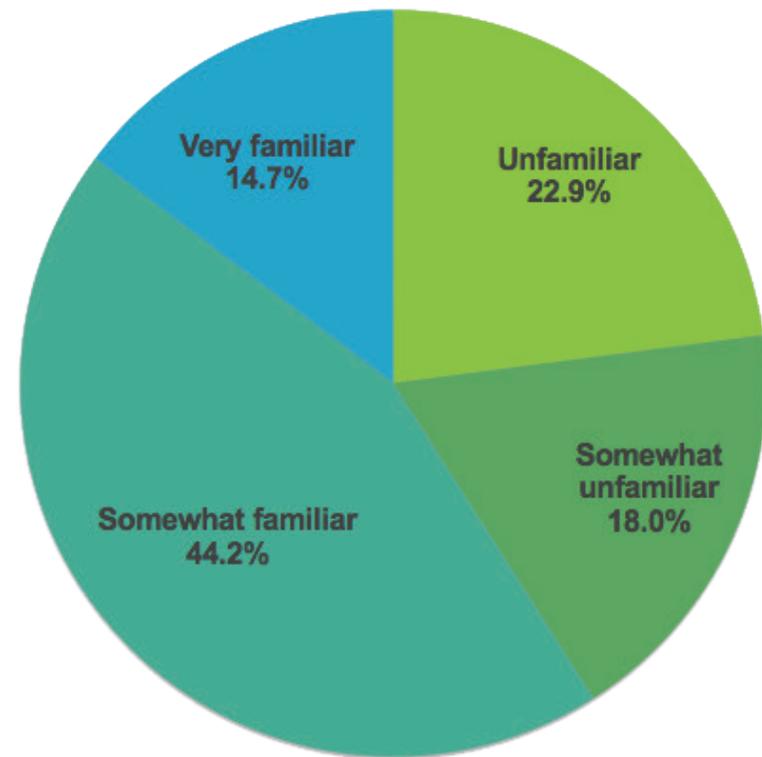
enabling cleaner labels and reducing food waste. The results also reflected the potential for even greater use of HPP as awareness continues to expand.

HPP FAMILIARITY, BENEFITS, BARRIERS

More than half of participants (59 percent) were familiar with HPP, with 57 percent characterizing their companies' use of HPP as some, growing or substantial. Among those using HPP, satisfaction with the technology was high. In fact, only one respondent expressed any level of dissatisfaction. And while the survey takers believed their retail and foodservice customers were usually favorably disposed to HPP, users of HPP more often than not thought their customers were unaware that they utilized the technology.

The most recognized benefits of HPP were its abilities to (1) make food safer by killing pathogens and (2) extend shelf life. Both scored, on average, above a four on a five-point scale. Other benefits cited include (in descending order) the ability to: pasteurize products within their packaging; preserve

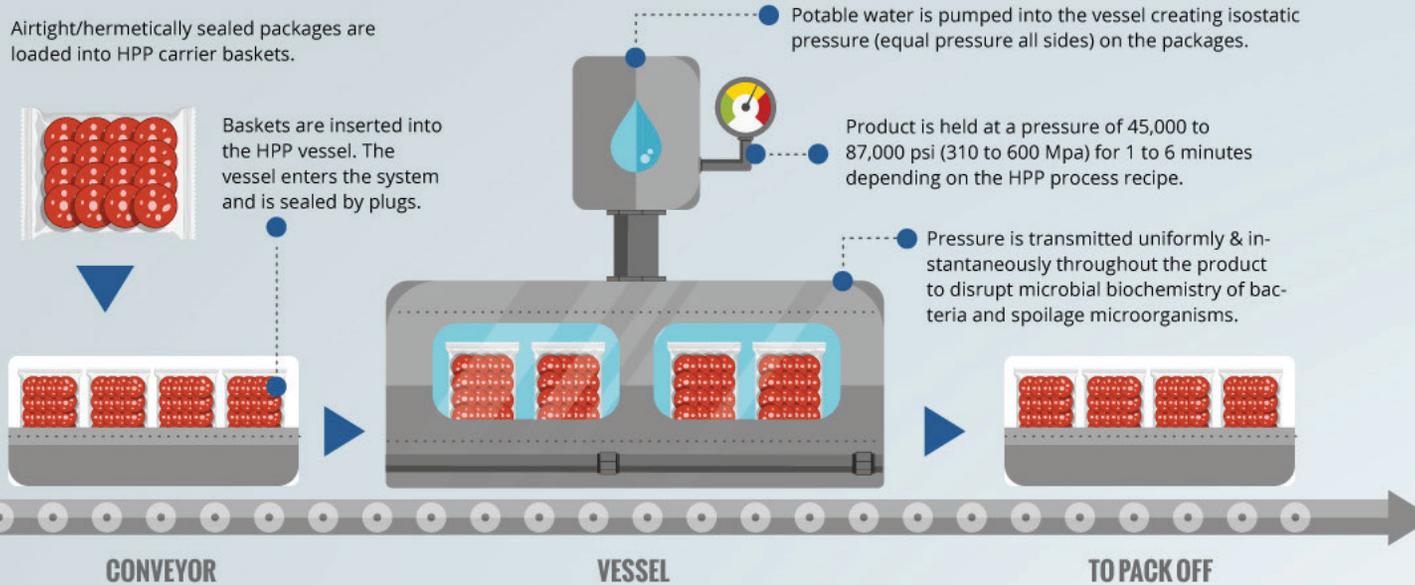
FAMILIARITY WITH HPP



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How HPP Works?

Airtight/hermetically sealed packages are loaded into HPP carrier baskets.



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Please contact us to learn more about how HPP can help advance your food safety and food waste reduction initiatives, support cleaner label efforts, strengthen your brand equity and create value.

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nutrients; develop cleaner labels; and reduce food waste.

When asked about potential barriers to HPP adoption, respondents cited the cost of equipment and cost of service as the main concerns. In some cases, HPP simply didn't work with their food type's process.

PASTEURIZATION PRIORITIZATION

The survey did not measure HPP in isolation, but instead compared its perceived advantages in food waste, food safety and food quality with several methods of pasteurization. The methods included:

- Ultra-high temperature pasteurization (UHT);
- High temperature/short time pasteurization (HTST);
- Low temperature/long time pasteurization (LTLT);
- High pressure processing (HPP);
- Pulsed electric field radiation (PEF);
- Ultraviolet radiation (UV); and
- Membrane filtration.



HPP scored noticeably above all other options for its impact on food quality. It earned an average of 3.85 points on a five-point scale and received the most five-star ratings (out of five) for the category.

As it pertains to food safety, UHT was rated the highest in the set with 3.95 points. HPP scored a close second with 3.83 points.

More than three-quarters of the survey field said that the issue of food waste was “somewhat important” or “very important” to them and their company. Among the seven types of processing, HPP again scored best in terms of having a positive impact on food waste with a mark of 3.62. The number of

five-star ratings given to HPP for its impact on curbing food waste was again the most among the various technologies.

The survey was conducted online in September and October 2016 and completed by individuals presently working in refrigerated or frozen foods. Roughly one-third of respondents came from companies that produce meat, poultry and seafood (33.3 percent), another third came from juice or beverage firms (29.8 percent), and the remainder came from other companies, including those that make wet salads/dips/sauces, dairy products, soups and various, other ready-to-eat foods.

WINNER, WINNER, CHICKEN DINNER: HOW HPP HELPED CHAIRMANS FOODS GROW SALES

It's a scene that might not seem so profound at first glance. Chris Staudt found himself seated around a table engaged in conversation about chicken casserole. But it wasn't a dinner table he was at, and it wasn't just any conversation. It was a business discussion about how to extend the shelf life of the gourmet casserole, which his Nashville-based employer, Chairmans Foods, was to manufacture and sell for the first time ever within commissaries connected to one of the country's largest retailers.

The chicken dish already had a successful food safety kill step as part of its processing, so it was perfectly safe as a frozen food. But in this case, it was imperative for the product to be introduced as a fresh product. Classifying as a ready-to-eat (RTE) food was



“mission critical” for the customized food producer and packager, and in order to make that happen, the shelf life throughout the supply chain needed to span 60 or more days.

That’s when the idea to apply high pressure processing (HPP) to the casserole product was born. Familiar with HPP’s ability to address pathogens, maintain nutrients and prolong the life of other products, Staudt and his batch-crafted food solutions team at Chairmans reached out to Universal Pure to experiment with applying the technology to their food. Following a brief period of testing and validation, Chairmans began to mass-produce the RTE product with Universal Pure’s value-added service support, first in Lincoln, Neb., and then in Villa Rica, Ga., after Universal opened that facility, less than 250 miles away from Nashville.

“Our experience with the chicken was the positive first impression that really began to open up new ideas and possibilities,” said Staudt, who is business development director for Chairmans Foods. “We

began to think about not only how HPP could help protect our brands, but enhance their features and values in the marketplace.”

Fast-forward five years: The casserole has become a nationwide sales success, achieving double-digit growth each year in rotation.

Having experienced the potential of HPP

firsthand, Chairmans

began to frequently sell HPP-applied food

to its grocery, C-store,

foodservice, hotel and other

customers as a value-added offering, not only for its

proteins, but for cornbread stuffings and myriad wet or spoonable salads like pasta salads, tuna salads

and chicken salads sold in delis and other

grab-and-go venues.



“We are a broad-based food manufacturer that deals with lots of different kinds of foods, and HPP has opened important new doors for us.”

- Chris Staudt, business development director, Chairmans Foods

Though other factors have contributed, HPP has no doubt helped the company grow its sales from more than \$10 million in 2011 to more than \$25 million today.

“We are a broad-based food manufacturer that deals with lots of different kinds of foods, and HPP has opened important new doors for us,” said Staudt. “It not only gives us a solid food safety mechanism, it also allows us to be nimbler and more flexible in our offerings and to align our capabilities with changing market demands.”

“We’ve seen firsthand, for example, the evolution towards people desiring cleaner ingredient decks and wanting to find them in different parts of the store,” he concluded. “HPP processing has given us the opportunity to meet those objectives and conduct more business.”

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- ✓ Pre-pricing



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HIGH PRESSURE IS RISING

Companies of all sizes are taking advantage of the food safety benefits that high pressure processing brings

BY SAM GAZDZIAK

In the never-ending search to create a safer food product, one of the recent developments that has shown the most promise is high pressure processing. The HPP process involves subjecting packaged food products to extreme high pressures. This non-thermal pasteurization inactivates food pathogens and extends the shelf life of those products.

According to business intelligence provider Visiongain, the global HPP food market was to reach approximately \$9.8 billion in 2015, across all food items. The group estimated that more than 350 industrial HPP machines would be installed worldwide. Along with the aforementioned meat products, fruits, vegetables, juices and dips are all frequently processed through HPP equipment.

Installation and operation of HPP equipment requires more than just finding some space on a

shop floor. Due to the nature of the process, many companies that have bought the equipment have had to expand or build a new building, complete with a reinforced concrete floor.

“High pressure processing has a few components. One, you have a pressure-generating unit. The second one is the cylindrical structure to contain the pressure. The third one is the computer to control the data,” explains V.M. “Bala” Balasubramaniam, professor, Food Engineering at The Ohio State University. “To contain this very high pressure, you have to use a very massive steel structure. Depending on the capacity of the system, you probably need to have a reinforced floor.”

Balasubramaniam explains that pressure generated with standard thermal processing is in the range of 25 to 50 pounds per square inch (psi). On the

other hand, high-pressure equipment generates about 87,000 to 100,000 psi. A regular processing plant floor would not hold up to sustained use of HPP equipment.

The need for a specialized building, as well as the cost of the equipment, has made HPP machinery a cost-prohibitive purchase for many companies. For that reason, a market has sprung up for third-party HPP tollers, who can take other company's product and run it through their equipment for a fee. Small and large companies can use a toller to achieve the food safety and shelf-life benefits of the HPP process without having to make the capital investments themselves.

For any processor looking to find a toller or to purchase the HPP equipment themselves, it is important to note what high pressure processing is and is not. It is an important addition to an already-strong food safety program. It is not,



however, a “silver bullet” — something that will eliminate any concerns about food recalls.

“From my perspective, pressure is one of the several tools available in the arsenal of modern food processor. It is a tool that needs to be used properly to fully utilize the benefits from this,” says Balasubramaniam.

He, along with Gustavo Barbosa-Cánovas and Huub Lelieveld, has written a book, “High Pressure Processing of Food: Principles, Technology and Applications.” It presents a comprehensive overview of HPP technology and summarizes everything from process engineering, regulations, application and consumer acceptance. It is available for purchase at <http://www.springer.com/us/book/9781493932337>.

Balasubramaniam recommends that companies interested in the technology do their homework before jumping into using it. For instance, high pressure requires food with a high moisture content to accomplish some of the work. A dry solid product might not work as well.

Maintaining the quality of the food is also a concern, and finding the right temperature/pressure combination is vital to using the equipment correctly.

“From my perspective, pressure is one of the several tools available in the arsenal of modern food processor.”

- V.M. “Bala” Balasubramaniam, professor,
The Ohio State University

Applying a higher pressure will inactivate the pathogens, but it may reduce the quality of the food. Less pressure will maintain the integrity of the food, but it may not be sufficient to kill the microorganisms.

“What happens under those conditions, it may shock them or injure them, so they may appear to be dead, but under certain storage conditions, they may come back,” he says. “That’s why I think the proper thing is to understand your product and microbiological kill so that those things don’t happen.”