

Innovations in Food Safety



by H. Louis Cooperhouse

According to Food Spectrum industry estimates and projections, prepared refrigerated foods sold through U.S. supermarkets will grow from \$9.5 billion in 2001 to \$12.2 billion by the end of 2005. Of that total, it is forecasted that the entire category of value-added produce will grow to \$5.2 billion in 2005. Sizable gains in both value-added vegetable products and value-added fruits will contribute towards the growth of the produce category. These products, like other fully prepared refrigerated foods, represent a "new generation" of prepared refrigerated foods which are growing and evolving very quickly, and are effectively responding to consumer desires for convenience, variety, quality and health.

However, the dramatic growth in the fresh-cut industry that is forecasted may lead to a corresponding dramatic increase in the incidence of food-borne disease outbreaks in this country unless preventative measures are implemented. Food safety is an extremely important consideration with refrigerated foods in general, and this issue is particularly relevant with value-added produce products. Although America's food is among the safest in the world, 76 million illnesses, 325,000 hospitalizations and 5,000 deaths annually are due to food-borne disease in this country, according to the Centers for Disease Control and Prevention, and value-added produce products are a leading cause of these outbreaks.

An HACCP Approach

Adequate food safety of refrigerated foods can only be achieved with a high degree of assurance by formulating, adapting and using a Hazard Analysis and Critical Control Point (HACCP) approach. By judicious application of HACCP systems, the food processor can implement a program whereby safe production conditions are achieved.

HACCP techniques assess everything from raw ingredients to product packaging and distribution, define the locations at which potential hazards (microbial, chemical and physical) may occur, and establish a means of monitoring these points to eliminate potential hazards.

It is critical to understand the technologies and best practices associated with the processing of value-added produce, literally from "farm to fork" as these individually and collectively impact both product safety and product quality, and ultimately impact the potential for market viability.

New technologies have been recently introduced, and others are on the horizon. Collectively, they will enable even greater alternatives towards the development of refrigerated prepared products that meet consumer needs for safety, as well as quality, convenience, and overall value. Such technologies are "hurdles" and are preventative tools designed to provide incremental assurances of safety, and extend the bacteriological and/or sensory shelf life of the food product. Hurdles are effectively "tools in the toolbox" that can be utilized by processors of fresh-cut produce and others involved in the product's chain from farm to fork.

It is essential that hurdle technologies be utilized, because we cannot rely exclusively on the maintenance of refrigerated conditions to assure the safety of these perishable foods. In fact, refrigeration alone is not enough to prevent the growth of some infectious or toxigenic microorganisms. With so few bacterial cells necessary to cause certain types of food borne disease, growth on infested produce is not a requirement for human infection, as with most other pathogens. Therefore, refrigeration of harvested produce is not a sufficient control, although it is of great value and is a contributing hurdle. In addition, post process contamination, even at low levels may create a situation where

pathogenic microorganisms may grow to high levels and cause illness and potentially death. Therefore, other barriers to microbial growth must be incorporated into these foods to yield a safe and stable system.

Clearly, raw material control and superior agricultural practices are critical to the successful development of value-added produce products. Variety, source, season, initial maturity, processing maturity, slicing and cutting equipment, chemical or other treatments and dips, packaging environment, temperature management, shipping, and handling all affect the sensory acceptability and attainable shelf life of fresh-cut produce while impacting product safety.

Key Tools

Preharvest contamination-prevention programs and postharvest sanitation are key tools to preventing outbreaks. Some farming practices that were considered safe in previous years are a current liability today. On-farm prevention programs should include basic sanitation practices for all harvest containers, contact surfaces, and postharvest washing. Washing fruit and vegetables with clean, potable water and a chemical disinfectant will result in a 1-3 log reduction (or 10 to 1,000 fold reduction) but have not been shown to eliminate microbial contamination. In fact, some pathogens are very resistant to chlorine, for example, and even sensitive ones such as *Salmonella* and *E. coli* may be located in inaccessible sites on the plant surface.

It should be noted that even effective chlorine concentrations are reduced by temperature, light, and interaction with soil and organic debris, so wash water should be tested routinely. Disinfectants utilized include chlorine and chlorine dioxide, hydrogen peroxide, peroxyacetic acid, bromine, iodine, trisodium phosphate, acetic and/or lactic acids and ozone. Current best practices also

include steam treatment to disinfect surfaces of whole fruits, for example, which can result in a 5-log or greater reduction of microbes, including *E. coli* O157:H7.

Hurdles can be incorporated further "downstream" as well. These include direct addition to or on the raw material via wash aids or other means that incorporate acidulants, antimicrobial agents, antioxidants, heat (e.g., blanching), and processes that control water activity. In addition, non-thermal processing hurdles can now be applied such as ultra high pressure processing, irradiation, and pulsed light and pulsed electric field processing. And lastly, hurdles can be applied during the packaging process, and include the application of modified atmosphere packaging (MAP), clean room packaging, active packaging systems, intelligent packaging systems, and a variety of alternative packaging materials. Synergistic results can be achieved when hurdles are used in combination, and are a very important consideration. Many of these technologies have been shown to significantly reduce levels of food spoilage and pathogenic microorganisms such as *E. coli* O157:H7, *Salmonella*, *listeria*, and *campylobacter*.

Modified atmosphere packaging via reduced oxygen may be a technology chosen to help a fresh-cut processor achieve a much longer shelf life. However, because MAP results in a dramatic change in the time it takes for product to spoil, and the type of bacteria that will cause this spoilage, it creates significant additional risk as well. Because resultant oxygen levels can be extremely low in the MAP package and held for a longer period of time, an atmosphere that is conducive to growth of anaerobic bacteria increases the likelihood that a pathogenic organism like *C. botulinum* can grow produce toxin, and cause food borne disease. However, incorporation of other barriers and microbiological challenge studies will minimize such risks.

Crisis Management Recommended

Fresh-cut produce processors are strongly encouraged to implement a crisis management program in light of these potential food safety issues. This will ensure that a crisis management team and effective procedures are in place, should there be a need to recall defective products and ensure the coordination of information and return of defective product to protect customers from health risk or fatality. A mock recall and trace back investigation will identify the potential sources implicated in a food borne outbreak, and determine and document the link in the chain that has been implicated during an epidemiological investigation of food borne illness. Fresh fruits and vegetables are extremely difficult to trace back because in most instances lot numbers and grower identifications are not used or recorded on receipt and shipping records. For this reason, it is imperative to identify a crisis management and trace back protocol that will be quick, efficient and as accurate as possible.

In conclusion, no innovative "magic bullet" exists that will allow for product safety in value-added fresh-cut products. Instead, it is the combination of multiple hurdle techniques that will ensure microbiological safety, extend shelf life and enable successful marketability. ■

Editor's Note: Lou Cooperhouse is president and CEO of Food Spectrum, LLC, a consulting and research company specializing in value-added foods. Cooperhouse can be reached at lcooperhouse@foodspectrum.com.

We didn't invent **Ozone**
we invented ways to make it work for you



For the last 15 years, ClearWater Tech has built industrial-strength ozone generators. In a world full of water treatment challenges, we put the natural power of ozone to work.

Ozone destroys a host of water-borne contaminants that can wreak havoc in a food processing operation, including bacteria, viruses, and molds.

The HDO₂ system is more than an ozone generator. It's a complete, precision-engineered ozone delivery system, ready to supply up to 7 ppm of ozone dissolved in water, whenever and wherever it's needed.

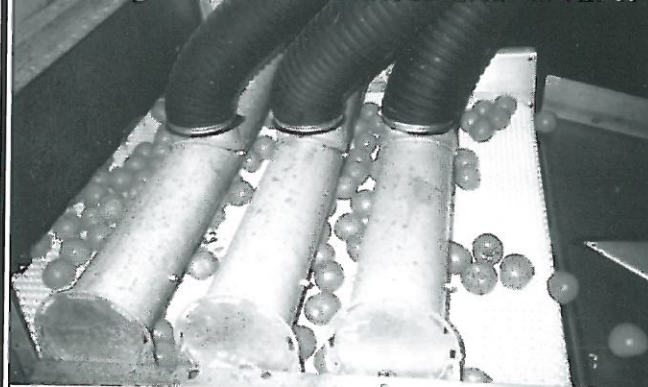
Put ozone to work for you.
ClearWater Tech Ozone

ClearWater Tech, LLC.
Water Purification Systems

650 E. Camino Real, San Luis Obispo, CA 93401 • 800-262-8293
fax: 805-549-0306 • e-mail: sales@clearwaterozone.com • www.cntozone.com



Blowing water off tomatoes after a rinse.



**BLOW WATER OFF OF
FRUITS, VEGETABLES,
LETTUCE, ETC.**

AIR BLAST INC.

Phone: 626.576.0144

Fax: 626.289.2548

P.O. Box 367, San Gabriel, CA 91778

E-mail: SALES@AIRBLASTINC.COM

Web Site: www.airblastinc.com

