

High Pressure Processing of Fresh Cut Fruits and Juices

Application Brief

HPP Technology: Food Safety, Extended Shelf Life and All Natural



Fresh cut fruits



Smoothie

As consumer demand for the convenience and health benefits of fresh all-natural cut fruit, vegetable products and juices has increased, so have expectations that these products be safe and maintain their sensory properties. Heat treatment and other processes typically destroy vitamins, and change the taste, not to mention other sensory properties, including appearance, natural texture and nutritional value.

High-pressure processing (HPP), a mainstream pre- or post-package process, leaves fresh cut fruits, vegetables and juices tasting just like freshly cut or squeezed. With HPP, fresh product is subjected to very high pressures (up to 87,000 psi), for less than three minutes resulting in the inactivation of harmful pathogens and spoilage organisms, including yeast and mold.

The results of published studies and those by Avure Technologies confirmed that the use of HPP on fresh cut fruits and juices can achieve the FDA HACCP requirement of a 5 log reduction of microorganisms – results that have been replicated by a study done by Health Canada on the same pathogens*. The FDA (5-LOG HACCP Rule), Health Canada and other federal regulators have approved HPP for use as a pathogen reduction process in these products (Figures 1 and 2) and other food categories as well, including ready to eat meats, seafood and shellfish, and wet salads and dips.

Beyond flavor profile and retention of nutritional value, specifically Vitamin C, folic acid, niacin, and antioxidants (Figures 3, 4 and 5), HPP extends refrigerated shelf life to at least 90 days, depending on packaging (Figure 6). Longer shelf life translates to increased distribution opportunities, reduced returns and sensitivity to cool chain abuse, and more efficient production scheduling.

HPP: Production Automation and Packaging Flexibility

HPP can be performed as a post-package process, with microbial reduction taking place in the final consumer package, reducing the need for sterilizing containers prior to filling. Product handling can be fully automated and post-intervention contamination risks are eliminated. This in-line pressurization method is compatible with other hurdle steps and can be incorporated into a HACCP plan.

Opportunity

High pressure processing offers substantial opportunity for fresh cut fruits and vegetables as end products and as process ingredients (e.g., fresh fruit blended with yoghurt). The benefit of retention of fresh fruit sensory qualities of taste, aroma, color, and nutritional content, adds great consumer value and new product opportunities, with the market for HPP foods now approaching \$2 billion worldwide.

Figure 1. **Apple Juice**

Pressure inactivation of foodborne pathogens in apple juice

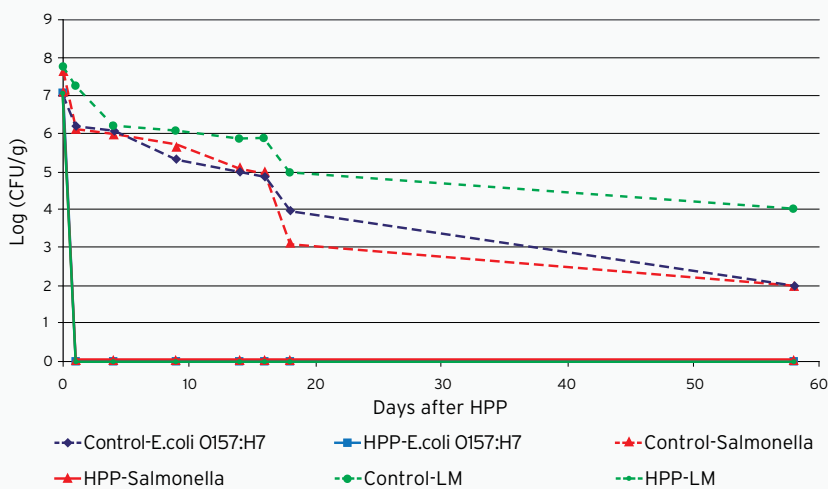
Pressure	HPP Time (Seconds)	6 Hours Post HPP	24 Hours Post HPP	1 Week Post HPP	1 Month Post HPP
		MPN/ml			
E. coli O157:H7 (9-Strain Mix) at 2.8 x 10 ⁶ CFU/ml					
80,000 psi [545 MPa]	Not Treated	7.8 x 10 ⁵ CFU/ml	7.0 x 10 ⁵ CFU/ml	1.1 x 10 ⁵ CFU/ml	4.3 MPN/ml
	30	460	<0.3	<0.3	<0.3
	60	<0.3	<0.3	<0.3	<0.3
Listeria monocytogenes (2-Strain Mix) at 2.3 x 10 ⁶ CFU/ml					
80,000 psi [545 MPa]	Not Treated	4.2 x 10 ⁵ CFU/ml	1.7 x 10 ⁵ CFU/ml	1.2 x 10 ⁵ CFU/ml	2.7 x 10 ⁴ CFU/ml
	30	240	<0.3	<0.3	<0.3
	60	<0.3	<0.3	<0.3	<0.3
Salmonella (8-Strain Mix) at 9.45 x 10 ⁶ CFU/ml					
80,000 psi [545 MPa]	Not Treated	6.1 x 10 ⁵ CFU/ml	1.7 x 10 ⁵ CFU/ml	1.9 x 10 ⁴ CFU/ml	4.3 x 10 ² MPN/ml
	30	<0.3	<0.3	<0.3	<0.3
	60	<0.3	<0.3	<0.3	<0.3

Storage temperature: 4°C

Data source: The National Food Processors Association (NFPA), Dublin, CA / Avure Technologies Incorporated, Kent, WA

* Novel Food Information, Applesauce and Applesauce/Fruit Blends Treated by High Hydrostatic Pressure – www.healthcanada.org

Figure 2. **Smoothie** (Strawberry & Banana)
Pathogen inactivation



Figures 3-5. Effects of HPP on Vitamin C, Folic acid and Niacin
in **Fresh orange juice**:

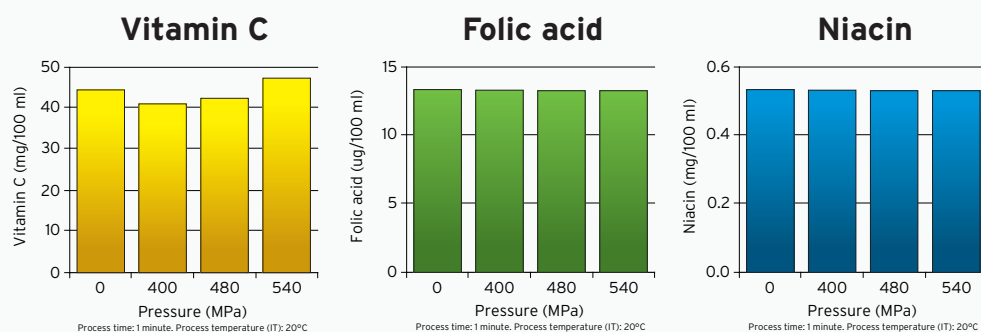
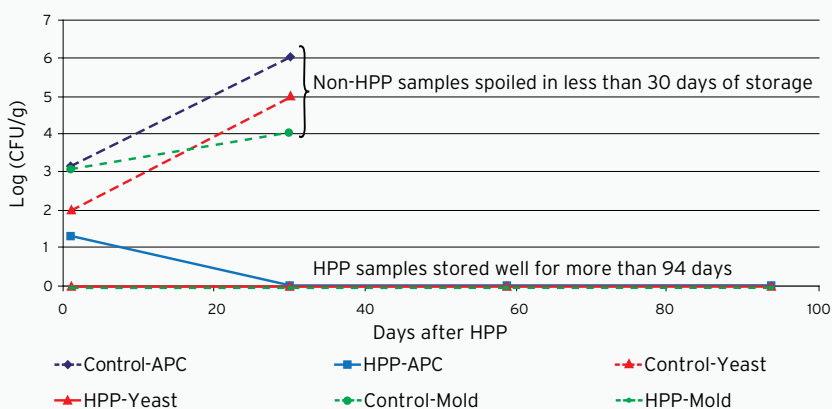


Figure 6. Shelf life of **Tropical fruit mix**



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With more than 50 years of experience and expertise, Avure Technologies is unmatched in the design of world-class high pressure presses.

Avure has an installed base of over 1,700 systems worldwide, including: sheet metal presses (Flexform), isostatic presses (hot and cold), high tonnage ram presses and food presses. All products and services leverage our in-depth expertise in delivering the finest high pressure solutions.

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