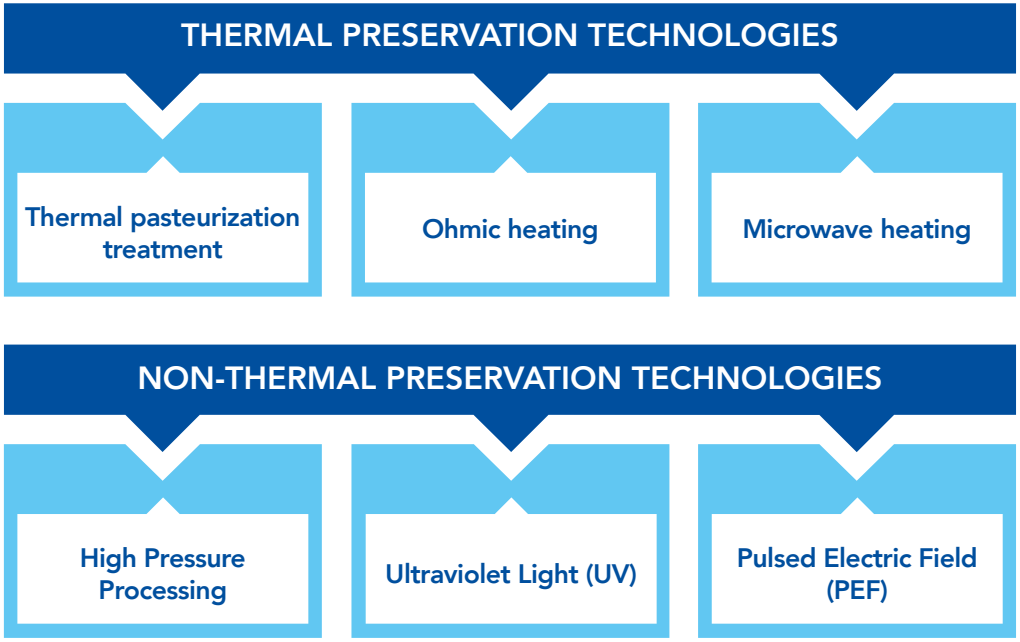
TETRA PAK FACT SHEET

Juice Preservation Technologies

OVERVIEW

- Evolving consumer tastes and market trends are bringing new opportunities and requirements for juice production. Consumers are demanding products that are natural, healthy and environmentally friendly. This demand is driving interest in new preservation technologies that allow producers to deliver these attributes for consumers while also lowering the impact on the environment and reducing production costs.
- Juice preservation techniques are designed to kill microorganisms, and restrict or prevent their growth therefore it is important to have the confidence of a long-proven track record of delivering food safety at a commercial level.
- There are two main types of preservation, thermal preservation and non-thermal preservation. Thermal preservation technologies use the temperature itself to secure microbial deactivation and commercial sterility ensure food safety; non-thermal preservation technologies can only achieve commercial sterility in combination with heat. These are outlined alongside further sub-categories in the below diagram:



Types of thermal preservation

- Thermal pasteurization uses temperature to secure microbial deactivation and therefore ensure food safety, either by hot water or steam. It is the most proven methodology and is by far the most widely used technique for 100% juice and other beverages, since it has a low total cost of ownership at commercial production capacities.
- At Tetra Pak we recently introduced a new approach to pasteurization that reduces the temperature of the second step of the two-stage process from 95°C to 80°C without compromising the safety of the juice produced. The result of this new approach is a saving on energy consumption of up to 20%.
- Ohmic heating uses an electrical current and is a rapid preservation method. The heat is distributed relatively uniformly, but can be different in the liquid compared to the particles and therefore the process parameters are dependent on the food characteristics.
- Microwave heating uses electromagnetic waves of certain frequencies. The heating is rapid but non-uniform, therefore making it challenging to predict the location of the slowest heating spot.

Considerations for using ohmic and microwave heating

- Ohmic and microwave are thermal preservation technologies that have some advantages when processing high viscosity particle-based products or products with a high tendency to foul. However, they may require additional checks to ensure that food safety is achieved at commercial levels.
- A robust critical process must be put in place to ensure safe, even heating has been achieved.

Types of non-thermal preservation

- High Pressure Processing (HPP) technology requires a pressure of 300-1000 MPa to deactivate microorganisms and are more likely to maintain fresh-like flavour and taste due to lower processing temperatures. However, this process requires cold distribution and storage from source to consumer, and to obtain sterilization requires a combination of high pressure and elevated temperatures in the range of 60-110°C.
- Ultraviolet Light (UV) treatment is commercially used for disinfection of water and it is possible to use for clear juices. All products need to be optimised individually due to the penetration ability of the UV light.
- Pulsed Electric Field (PEF) is a process based on short electric pulses at high intensity.

The future of juice preservation technologies

- It is important to ensure that the preservation process parameters used to ensure microbial deactivation are well proven and established and that the juice industry drives technology development in preservation to meet both customer demand and environmental targets, such as reduced energy and water consumption.
- Even long-established technologies are not standing still in this area. We continuously test new technologies and research trends, always looking for the best options for our customers.
- Preservation technology is at the heart of processing, and is essential for ensuring safe and nutritious products, which is even more important today as health and wellness becomes an increasing focus.

	Thermal treatment			Non-thermal treatment		
	Thermal pasteurisation treatment	**Ohmic heating**	**Microwave heating**	**High Pressure Processing**	**Ultraviolet Light (UVC)**	**Pulsed Electric Field (PEF)**
Process overview	Uses hot water or steam as heating media	Rapid treatment using an electric current	Rapid treatment using electromagnetic waves	Sealed product placed in water tank, pressurised up to 1000 MPa	Irradiation with high-energy, short-wavelength light. Widely used to disinfect water	Process based on short electric pulses at high intensity
Advantages	• Well proven technology: most widely used technique for 100% juice and other fruit beverages • Target organism well defined • Reliable • Efficient in high capacities, keeping production costs low	• Good for products with high viscosity, particles and/or tendency to foul • Instantly turned on and off, making it highly efficient • Target organisms well defined	• Good for products with high viscosity, particles and/or tendency to foul • Can be turned on and off instantly, making it highly efficient • Target organisms well defined • Can heat packaged food	• Good particle and flavour integrity, percieved as maintaining a more "fresh" flavour • Does not inactivate enzymes, which can be perceived as a more natural product	• No reported changes in physical food characteristics • Low capital and maintenance cost	• No reported chemical effects on product • Can handle fibers very well and particles fairly well
Disadvantages	• Heating via a hot surface which is fouled by the product	• Heat distribution can vary between liquid and particles • Requires well-controlled system to eliminate risk of non-uniform heating	• Requires well controlled system to eliminate risk of non-uniform heating that can lead to hot and cold spots	• Does not inactivate enzymes, resulting in a less stable product • Does not inactivate spores at ambient temperatures • Requires cold distribution and storage	• Very short penetration depth, product has to be treated in thin sheets • Products needs to be optimised individually • Not suitable for juice with pulp and/or fibre	Restricted to food that can withstand electrical fields, has low electrical conductivity and do not contain or form bubbles
Batch / Continuous	Continuous	Continuous	Continuous	Batch/semi-continuous	Continuous	Continuous
Process Temperature	95°C for high acid / 140°C for low acid	»70°C-140°C	»70°C-140°C	Ambient. (Can be combined with increased temperature)	Ambient	Ambient. (Can be combined with increased temperature)
Commercialised?	Yes	Yes	Yes, but limited when continous	Yes	Yes	Yes, but limited