Pulsed Electric Field Technology

The science of **Food-Physics™**

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Food-Physics

The science behind Elea

Getting more by doing less

With **Pulsed Electric Field (PEF)**

we can generate and accurately measure significant increases in yield, freshness and flavour preservation across a wide range of food types.

- Improving output
- Reducing labour costs
- Streamlining supply chain logistics
- Curtailing retail waste

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Winning more with PEF

PEF works by puncturing the cell membrane, whatever the size of cell. The process is targeted, gentle and clean.

- Dramatic increases in yield, preservation of pigments, antioxidants and vitamins
- Healthy products last longer

Products that work with PEF

- Microalgae, Kelp & Seaweed
- Vegetable oil, Herbal extracts
- Flower- and Flavour extracts
- Food supplements
- Nutrient media
- Pharmaceuticals
- Process water, cooling water
- Seafood & Fish
- Dairy products
- Marinades, sauces & dressings

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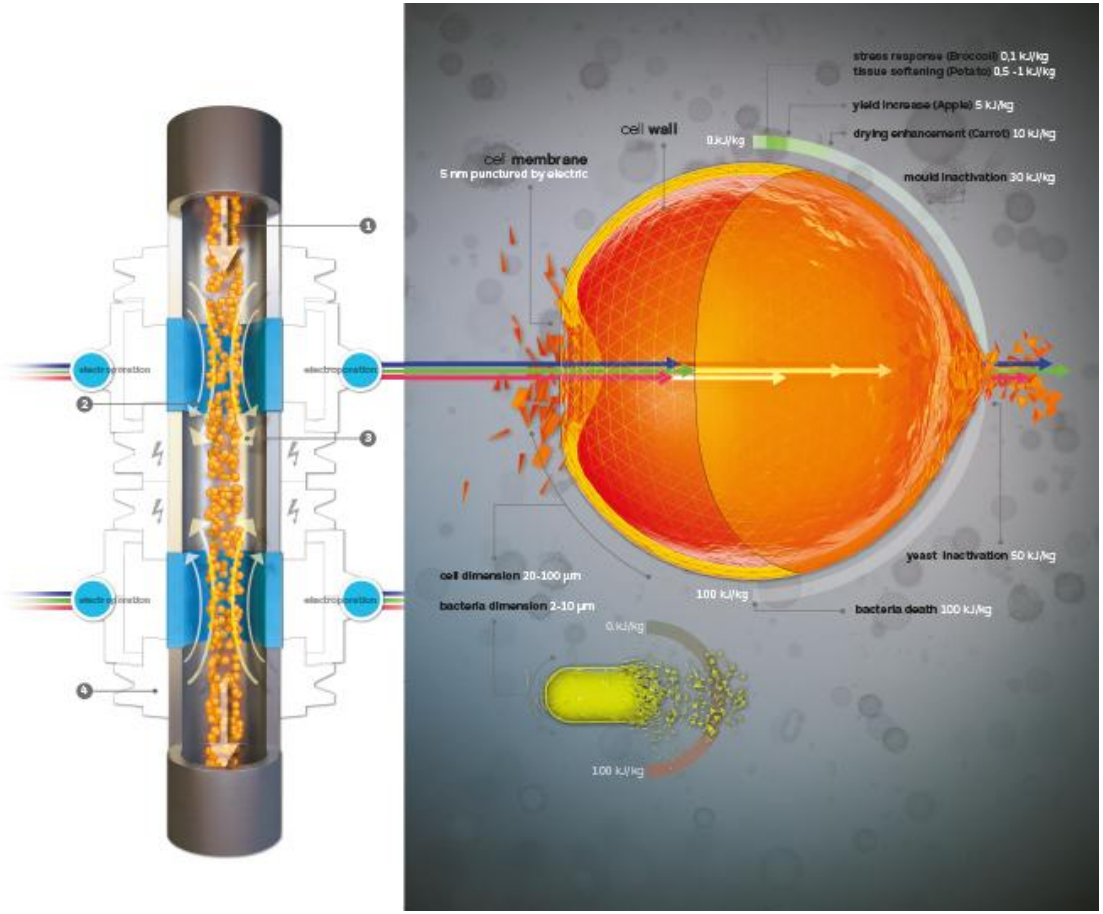
PEF science

With treatment times measured in seconds and with continuous operation and energy efficiency, PEF delivers more by doing less.

The cell membranes of microorganisms, plant or animal tissue can be made permeable by using Elea PEF technology.

This process of electroporation is suitable for use in broad range of food and bio-process using low levels of energy.

Diffusion processes, like water removal from plant or animal tissue or the absorption of marinades, spices and auxiliary substances are accelerated thereby saving valuable time in the production process.



Working with **Elea**

Elea and our partner DIL are driven by world leading food technologists.

With cutting edge Food-Physics, chemistry and microbiology laboratories alongside unrivalled pilot hall facilities, Elea offers a new opportunity to create new process, products and to measure value.

Our scientists are able to research and develop highly efficient process solutions using Food-Physics and our designers and engineers can put it into practice.

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Elea PEF engineering

Elea designs and manufactures machines of outstanding quality for your production line.

Our focus is on physical processes to enhance food quality and safety.

Each Elea system is built with the highest quality German engineering to withstand continuous operation and deliver maximum performance and energy efficiency.

Since 2009 PEF systems designed by DIL have been installed successfully into production lines worldwide.

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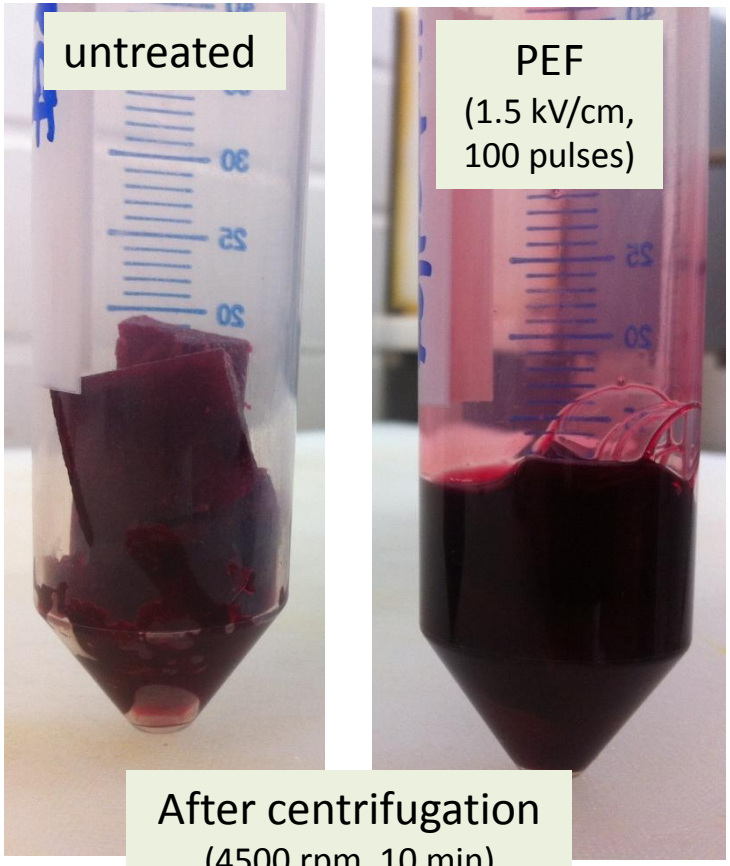
Our global reach

Elea is able to supply and support PEF systems globally. We offer a world wide service with highly skilled and trained engineers, ready to help with installation and maintenance.

Winning more – cell disintegration

Treatment of red beetroot



After centrifugation
(4500 rpm, 10 min)

- ✓ Cell structure is opened
- ✓ Facilitated liquid release containing betalains

PEF
(1.5 kV/cm,
100 pulses)

untreated

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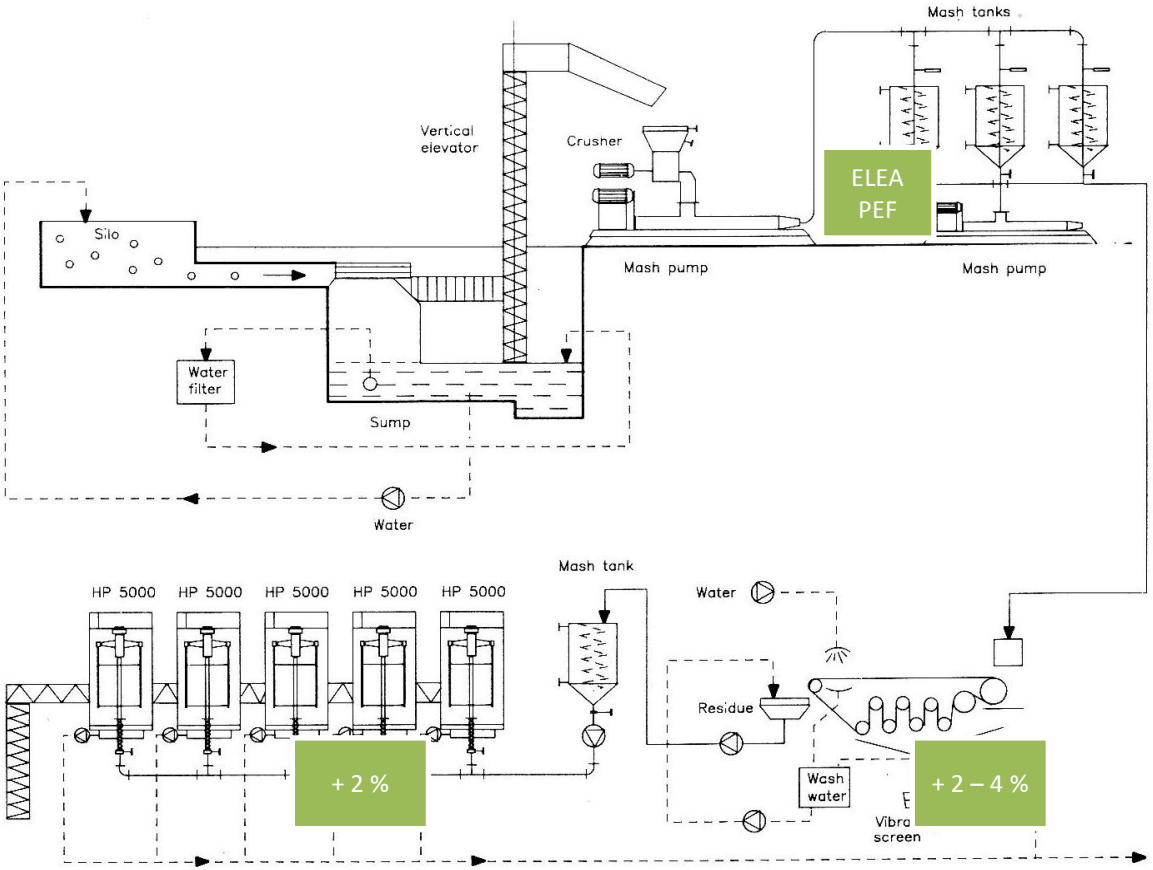
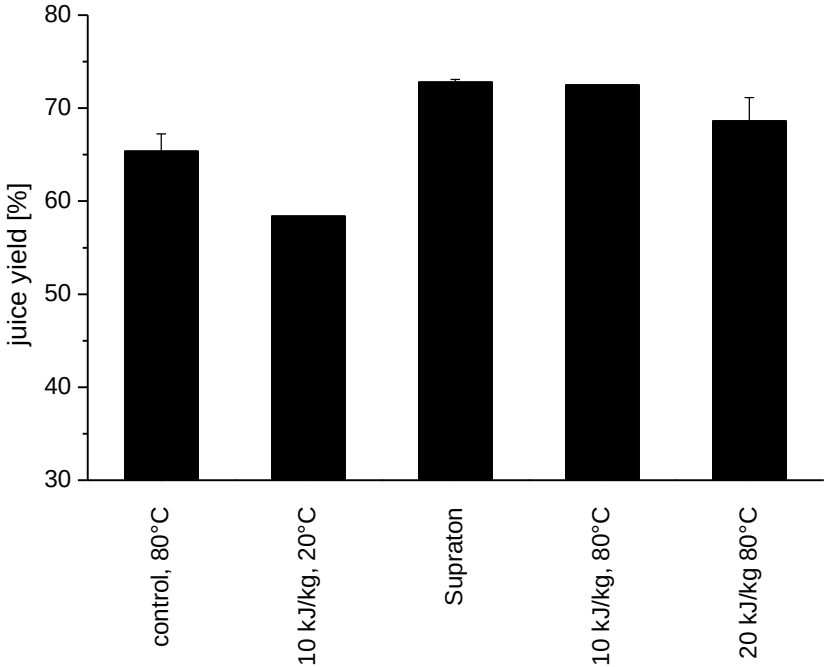
Winning more – apple juice



Cloudy apple juice production line: Juice yield shift towards premium quality juice

Winning more – carrot juice



Carrot juice yield using a decanter centrifuge after PEF (2 kV/cm) in comparison to control and Supraton®-homogenizer. To allow pumping and separation a temperature of 80°C was used.

During carrot juice production juice yield is increased from 65 to 73 % in comparison to an untreated sample and similar than after a mechanical grinding (Supraton®).

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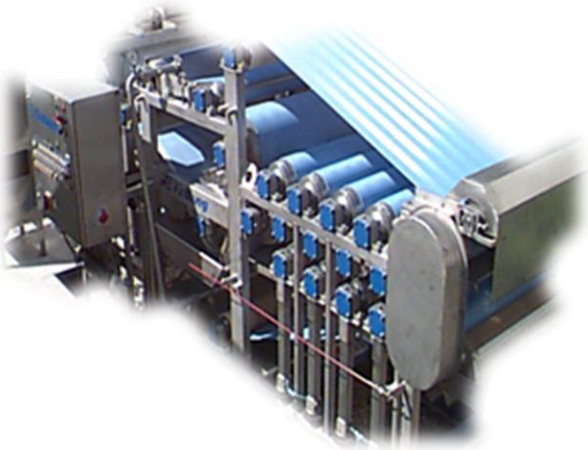
Winning more – carrot juice

Fresh carrrots → Grinding → Fine grinding
"Microcut MCH 20K"
Gap 0.35 mm



Bandpresse B-FRU-800
„Flottweg", 2 t/h

Mash

Untreated

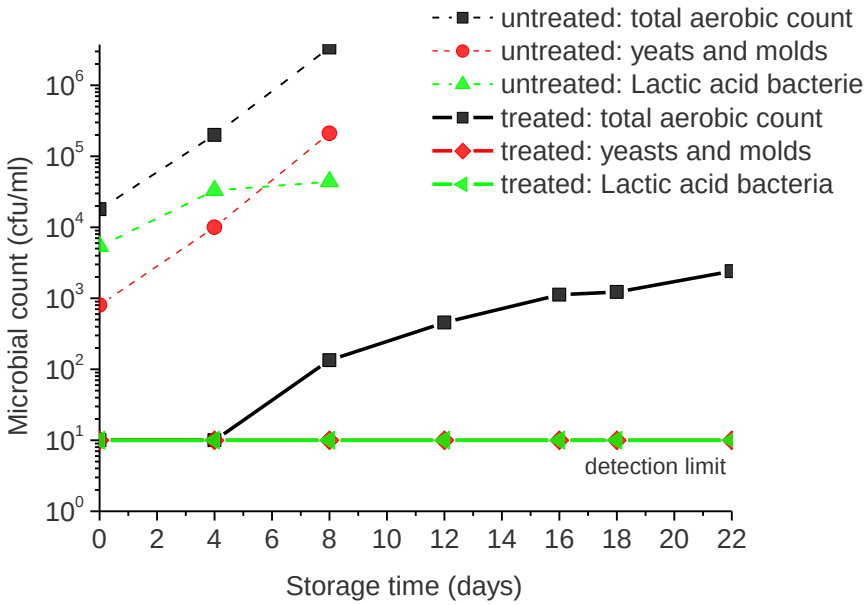
ELEA PEF

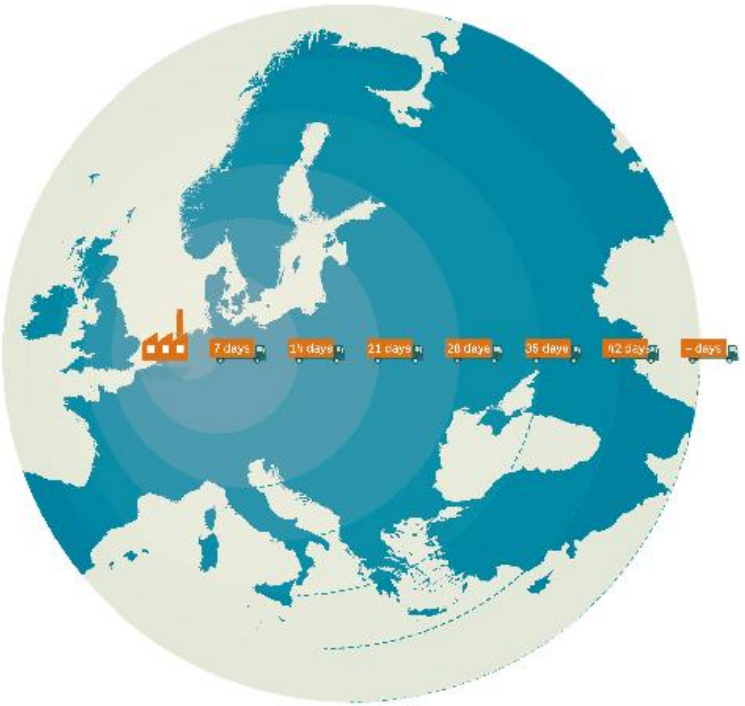
Belt press 2 t/h

Juice yield	71 %
Carotinoids	78 mg/kg
Pomace	DM= 15 %

Juice yield	84 %
Carotinoids	86 mg/kg
Pomace	DM= 23 %

Preservation – fresh juices





ELEA PEF preserves nutritional value better than any other processing method.

Extend shelf life and impact on supply chain logistics and market range

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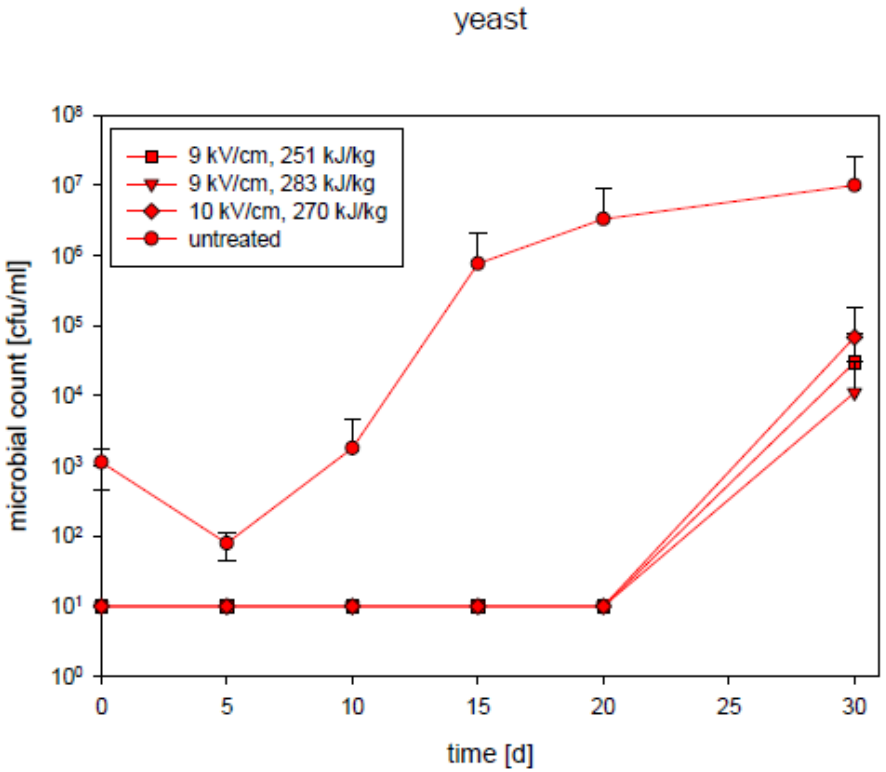
Preservation – cold soups



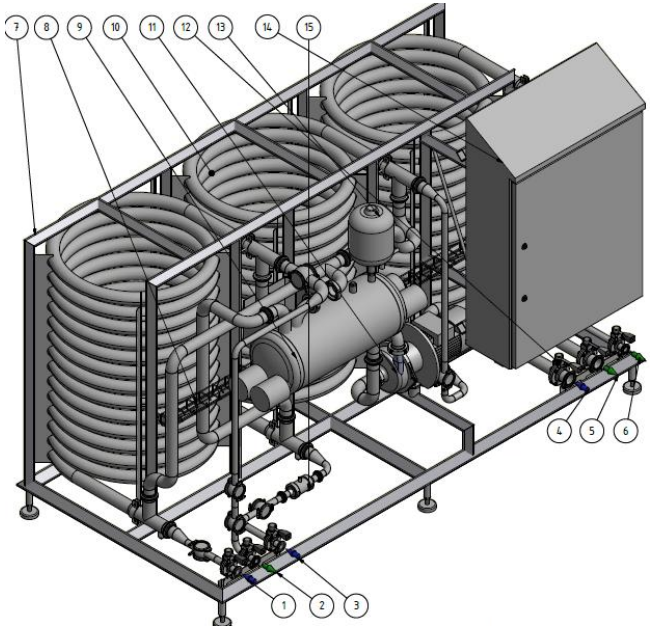
Microbial inactivation

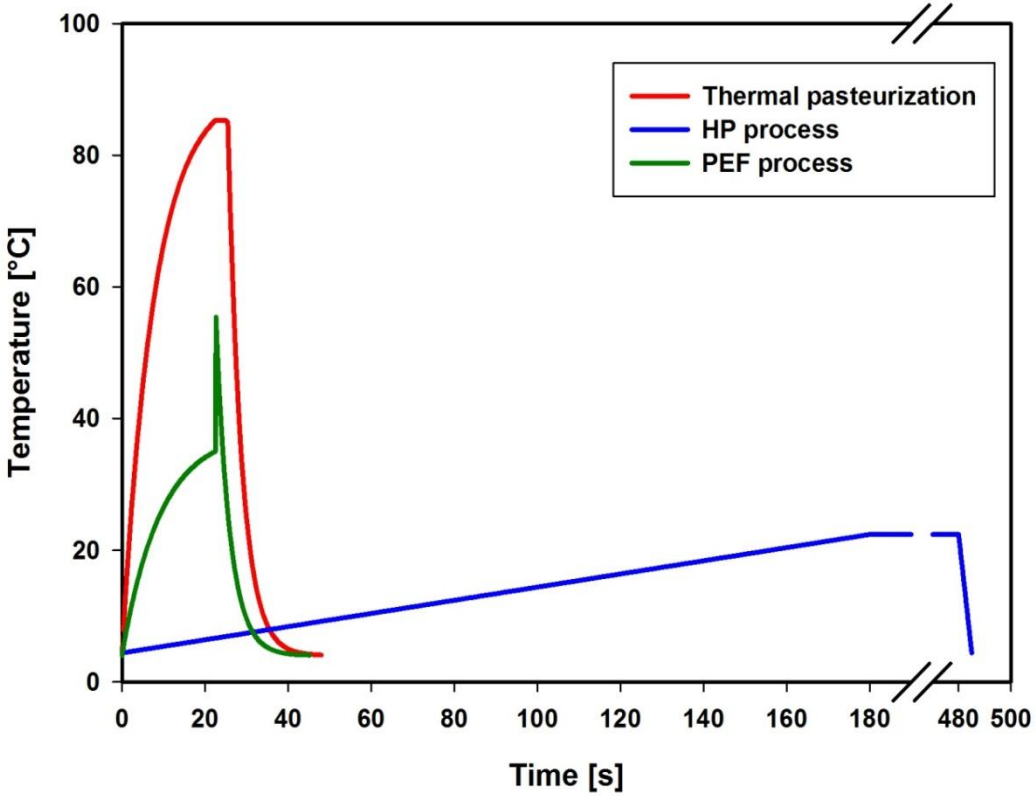
	Electric field strength [kV/cm]	Specific energy [kJ/kg]	Inactivation [log N/N_0]	Standard deviation
E. coli	untreated		0,0	0,0
	9	251	-5,3	0,1
	9	283	-5,7	0,1
	10	270	-5,0	1,0
L. acidophilus	untreated		0,0	0,0
	9	251	-3,7	0,8
	9	283	-4,5	1,0
	10	270	-2,4	0,3
S. cerevisiae	untreated		0,0	0,0
	9	251	-2,8	0,9
	9	283	-2,8	0,9
	10	270	-2,8	0,9
A. niger	untreated		0,0	0,0
	9	251	-4,2	0,5
	9	283	-4,4	0,3
	10	270	-4,1	0,4

ELEA PEF opens up a whole new world of opportunity in new product develeopment giving much more flexibility in product manufacturing

Preservation – minimal processing

ELEA PEF allows microbial decontamination at a low maximum temperature and short residence time. Continuous operability and low thermal load allow to retain product value at low operation costs.





	Thermal	HP	PEF
Operation	continous	batch	continous
Capacity	1000 l/h	200 l	1000 l/h
Start temp [°C]	4	4	4
Treatment conditions	85 °C, 3 s	600 MPa, 5 m	80 kJ/kg
Heating up	PHE/SHE		PHE/SHE
F-value [s] (T_{ref}= 85 °C, Z= 9)	7.58	$3.77 * 10^{-5}$	$1.47 * 10^{-4}$

Manufacturing economics

The economics of Elea **PEF**

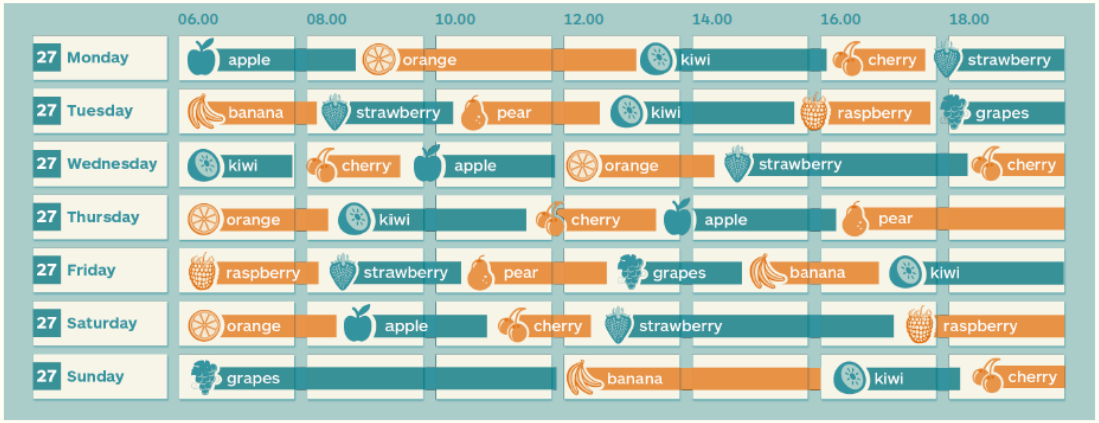
Production **planning**

Extended shelf life results in greater flexibility for your production planning. Combing scattered lots into larger batches, reducing overhead manufacturing cost.

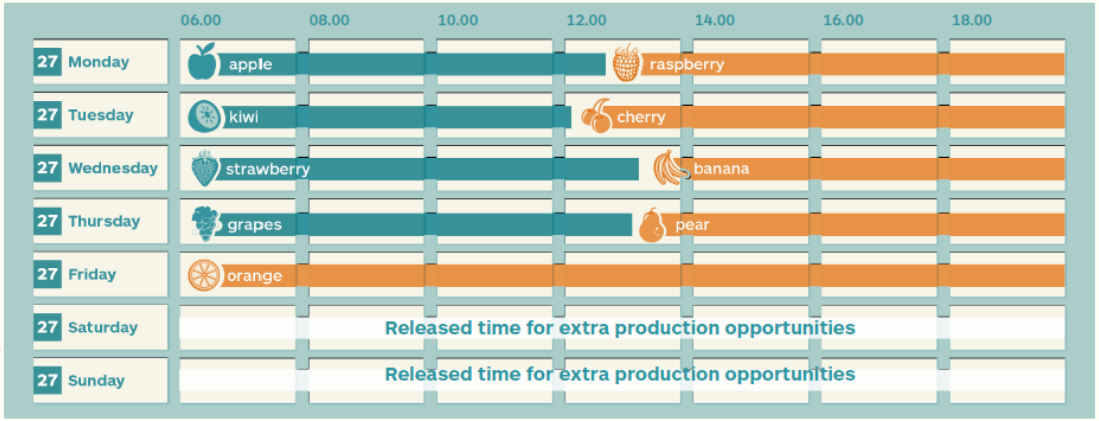
Use Elea **PEF** for

Fresh juices	Marinades
Smoothies	Dressing
Beverages	Nutrient media
Baby food	Process media
Dairy products	Enzyme solutions
Food supplements	Cosmetics
Health shots	Pharmaceuticals
Sauces	Protein concentrates
Soups	Emulsions

Production Planner Before Elea PEF — **27 May - 2 June 2013**



Production Planner After Elea PEF — **27 May - 2 June 2013**



Industrial installation

Hoogesteger, NL
(Irving 2012)

by Hoogesteger

Elea Vertriebs- und Vermarktungsgesellschaft mbH
Professor-von-Klitzing-Str. 7
49610 Quakenbrueck / Germany
www.elea-technology.com
+49 (0)5431 183 442