

High pressure pasteurisation of ready-to-eat meals

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Double Fresh
Double Fresh

Mild preservation technologies

- Trends:
 - Quality: fresh properties
 - Health: nutrients and functional ingredients
 - Convenience: ready-to-eat, on-the-go
 - Safety and shelf life
- Mild preservation: increase of shelf life in combination with preservation of fresh characteristics
- Novel technologies as one of the hurdles to achieve this:
 - **High pressure**
 - Pulsed electric field processing
 - Advanced heating technologies



High pressure processing

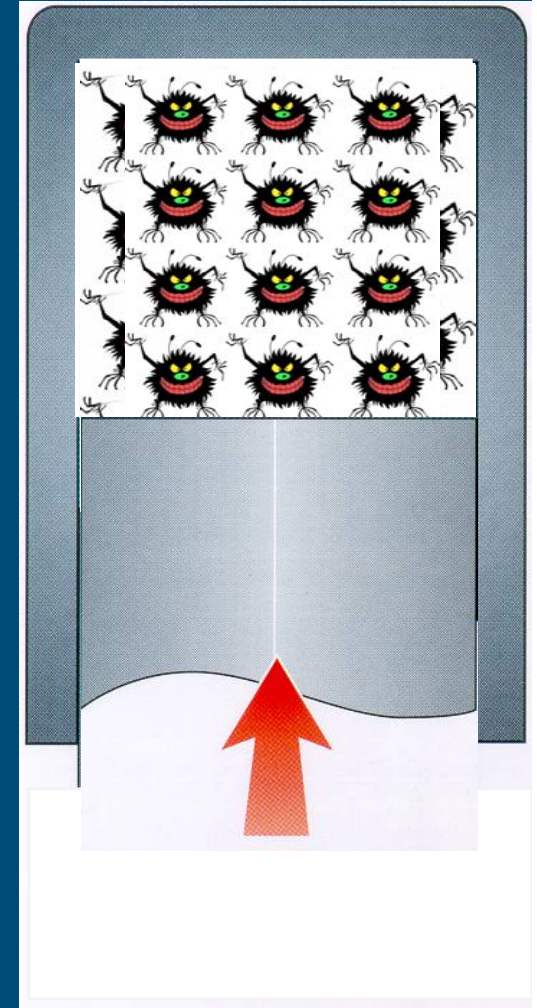
Content of presentation:

- High pressure processing: what is it?
- HP for ready-to-eat meals:
 - Progress made in Double Fresh
 - Progress made in NovelQ
- Commercial applications:
 - Presentation Carole Tonello, NC Hyperbaric



High pressure processing

- Batch, semi continuous process
- Iso-static: pressure is applied from 'all sides' and uniform
- Compression: water 10-20%
- Temperature: adiabatic temperature raise (about 3-6 ° C / 100 MPa)



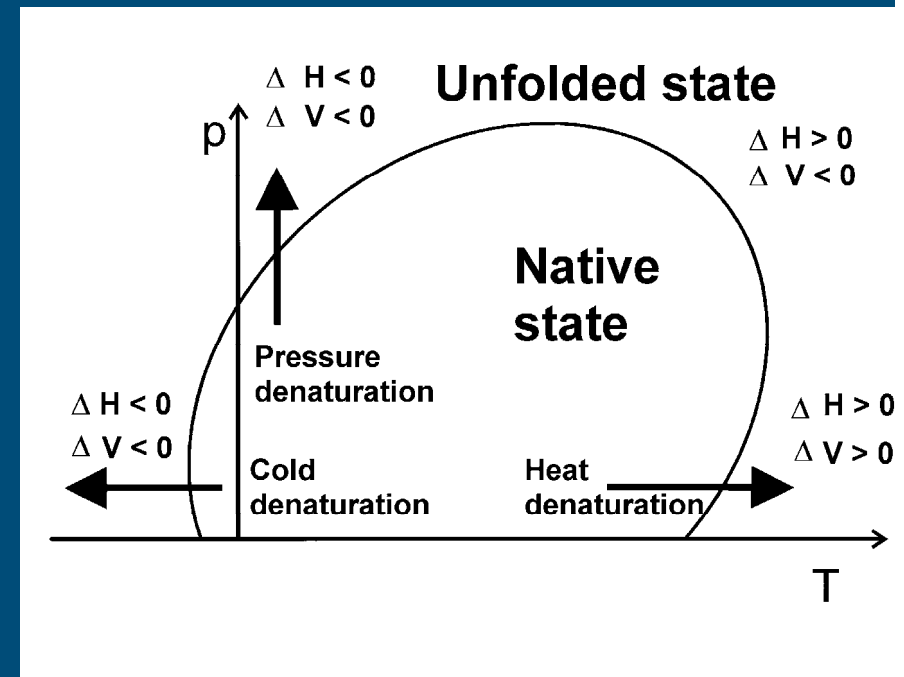
High pressure processing

- Pressure causes changes in volume: reactions are enhanced, e.g.:

- Denaturation of proteins
- Crystallization of lipids
- Small molecules in general less affected

- Effects depend on:

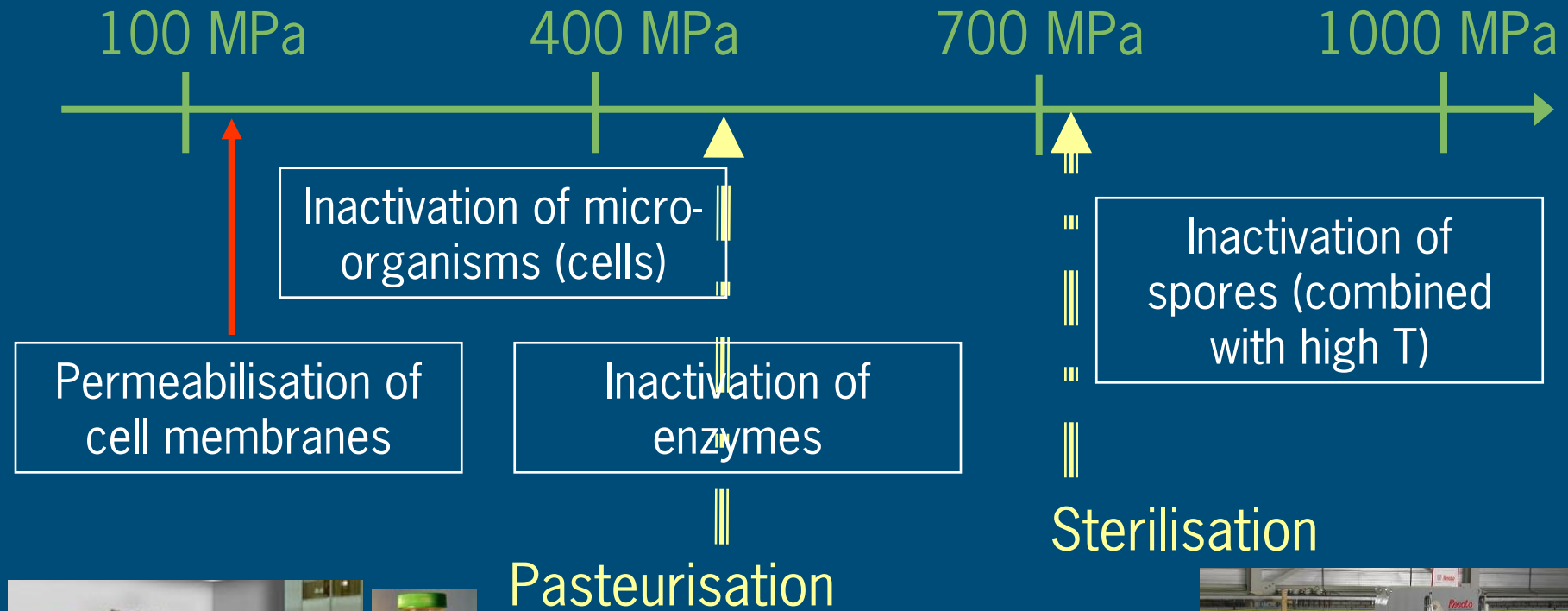
- Process factors: pressure, time, temperature
- Product factors: composition



Hendrickx, KULeuven



Effects and applications of HP



HP applications: pasteurisation

- 500-600 MPa
- Ambient temperature
- 1-10 minutes HP time
- Inactivation of enzymes and vegetative cells
- Refrigerated shelf life
- Commercial units available
- Approved in U.S. and EU for range of products
- Applied for range of food products
 - See presentation Carole Tonello
- Improved quality and shelf life
 - Applied for ready-to-eat meals in Double Fresh



HP applications: sterilisation

- 700-800 MPa
 - Elevated temperature: T_{start} 70-90°C, T_{max} 110-120 °C
 - 1-5 minutes HP time
 - Inactivation of enzymes and spores
 - Ambient shelf life
-
- First pilot unit available
 - Improved quality compared to retort
 - Researched in NovelQ
 - First approval of potato product in U.S.



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HP and ready-to-eat meals: general set-up

- High pressure pasteurisation
- Treatment: 600 MPa, 5 minutes, room temperature
- Refrigerated storage
- Separate ingredients:
 - Carrots, green beans, salmon, pasta
- Meals:
 - Boerenkool (mashed potatoes with cabbage and sausage)
 - Spaghetti bolognese
- Microbiology
- Evaluation of quality with standardised protocol



HP and ready-to-eat meals: microbiology

- Microbiology: first results **indicate**:
 - Log 6 inactivation of vegetative cells
 - No inactivation of spores
- Chilled meals possible with respect to microbiology
- For applications and of exact shelf life: determination of process conditions necessary



Results: Quality of ingredients 1



HP treated salmon:

- General impression better
- More fresh colour
- Better texture



HP treated carrots:

- General impression better
- Better texture
- Colour more fresh
- More juice separation



Results: Quality of ingredients 2



HP treated green beans:

- General impression better
- Less off odour
- Better texture
- Colour more green



HP treated pasta:

- General impression slightly worse
- Lighter colour



Results: Quality of meals 3



HP treated 'Boerenkool':

- General impression slightly better
- More green colour of cabbage
- Better smell
- Colour of potato less yellow

HP treated spaghetti bolognese:

- General impression better
- Better smell
- Darker colour of spaghetti
- Better texture of spaghetti and vegetables



Conclusions HP and Double Fresh

- HP pasteurized meals and ingredients have a fresher appearance treated with HP
- HP treated products have a firmer texture
- For the development of HP meals recipes have to be adjusted
 - Texture
 - Color
 - Taste
- Microbial data indicate a strong reduction in microbial count of HP treated product
- Package solutions necessary



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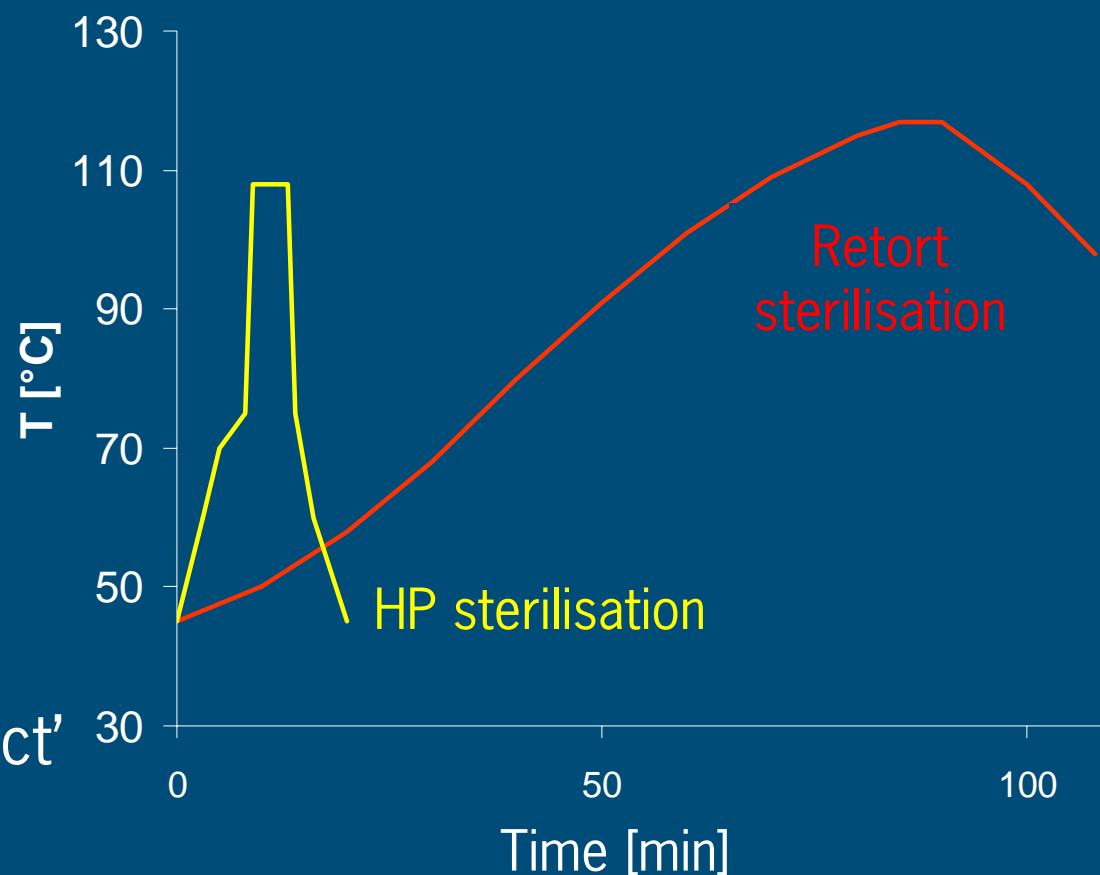
NovelQ



- European research project, coordinated by A&F
- Objective:
 - To develop and successfully demonstrate - eco-friendly - novel processing technologies (HPP, PEF, Plasma, advanced heating technologies and packaging) for improved quality food
- 36 Partners
- Industry Advisory Platform

NovelQ: focus on HP high temperature: sterilisation

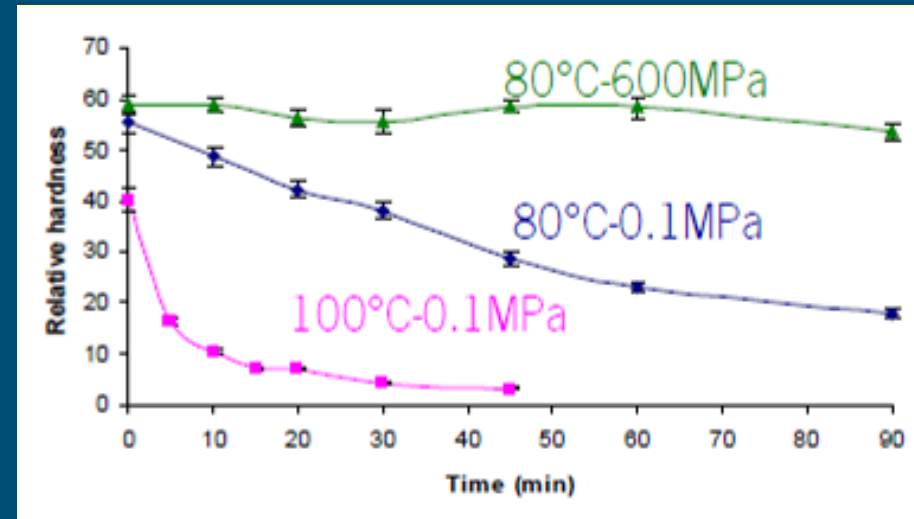
- 700-800 MPa
- Tstart 80-90°C
- Tmax 110-120 °C
- 1-5 minutes HP time
- Inactivates spores
- Inactivates enzymes
- 'Freshly cooked product'



HP high T research: effects on spores and enzymes

Example: use of P and T to maintain texture of carrots

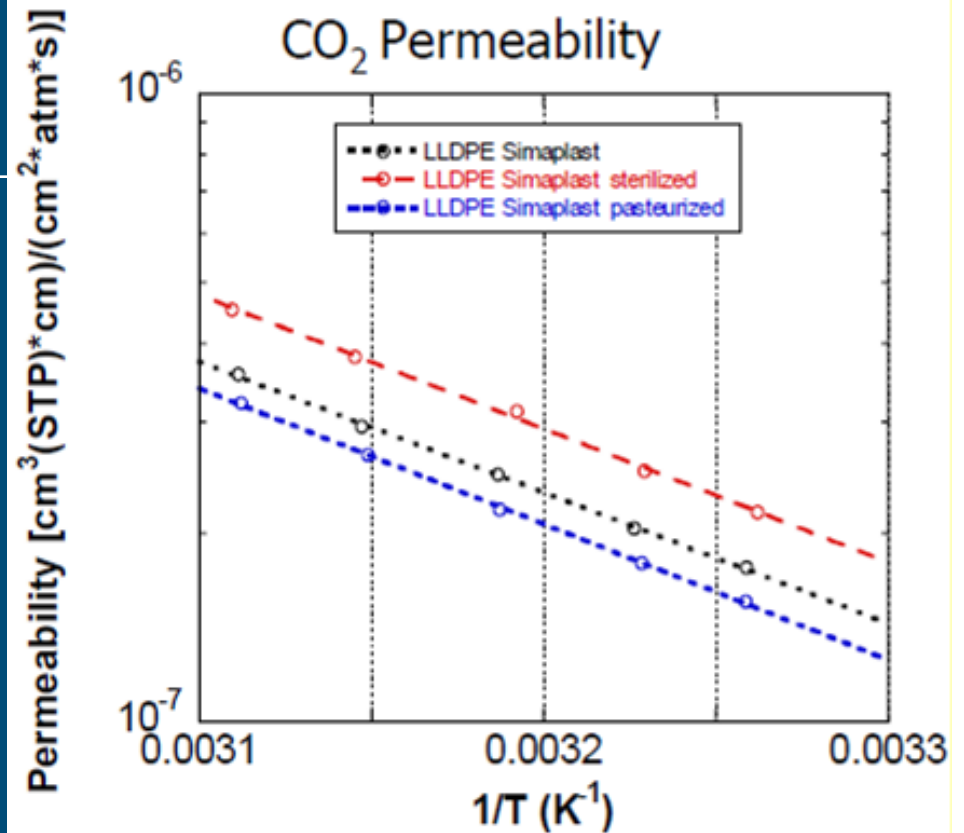
- Pectin conversions influenced by P and T
- Results in change in tissue integrity
- By selection pre-treatment and treatment hardness of fresh carrots can be maintained



Hendrickx, KULeuven

HP and packaging

- HPT effects on water solubility, permeability
- HPT effects on food interaction: migration, scalping
- Effects on packaging integrity



- P and T influences material properties resulting in structural changes in functional and mechanical properties
- Careful selection of materials needed, specific problems related to multilayer systems

Mensitieri, University Naples

HPT: development of equipment

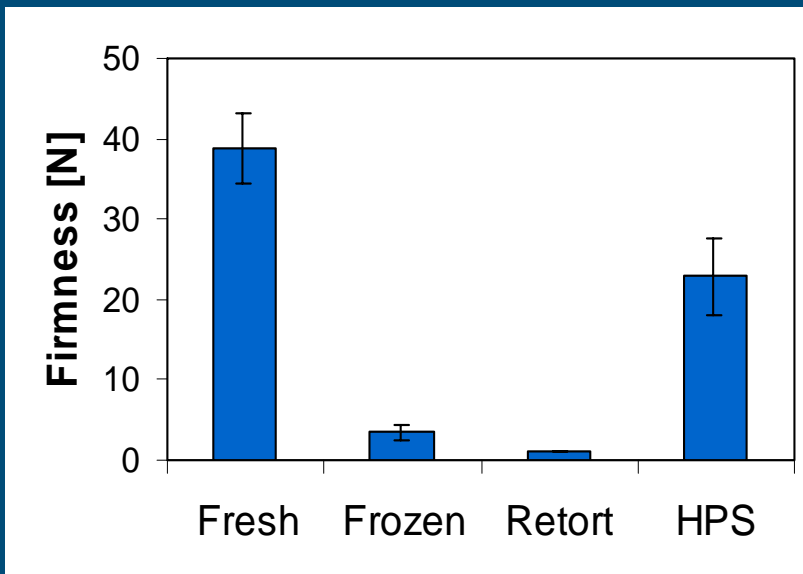
- Basic requirements:
 - Control of temperature during treatment
 - Short process cycle to maintain T
 - Reliability and safety
 - Costs
- High pressures, high temperature: serious requirements for materials and design
- Pilot equipment developed



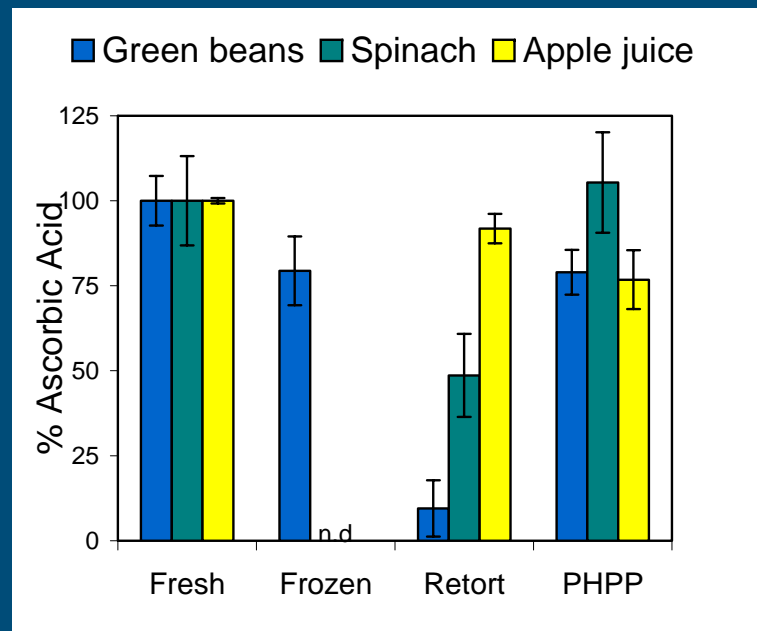
A&F, Resato, Solico

Product quality: examples of analysis

Firmness of green beans



Ascorbic acid



Product quality: examples of HP sterilisation (1/2)

Whole potato



HP sterilization - heat sterilization - Blanc

Salmon



HP sterilization - heat sterilization - Blanc



Product quality: examples of HP sterilisation (2/2)



Blanc



HP sterilization



Heat sterilization



Blanc



HP sterilization



Heat sterilization



Conclusions

- HP sterilisation can have positive effects on quality and shelf life
- Research topics:
 - Safety of the process: spore inactivation
 - Packaging integrity
- Pilot equipment available, no industrial equipment available
- Product quality: HP sterilisation can have advantages compared to retort processing

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