

Enzymes of interest in apple and tomato juices

POLYPHENOL OXIDASE (PPO)

Catalyses the oxidation
of phenolic compounds

Enzymatic browning



PECTIN METHYLESTERASE (PME)

De-esterifies pectin

Synergistic effect

Insoluble precipitates

Loss of cloud stability

Reduction in viscosity

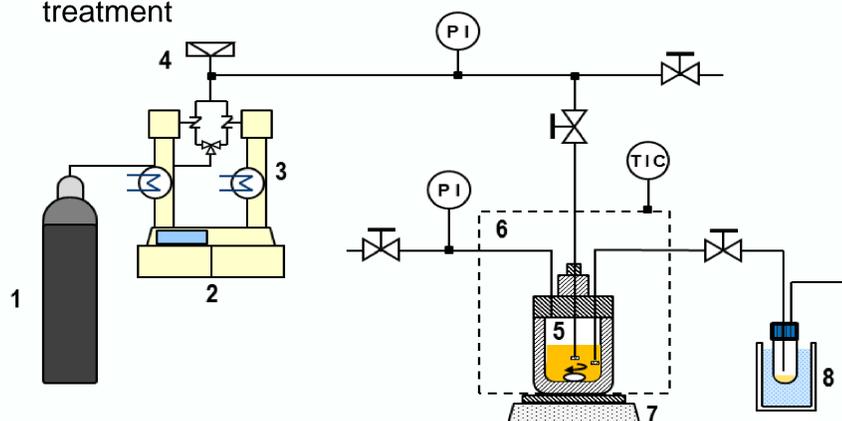


POLYGALACTURONASE (PG)

Hydrolyses α -D-(1-4)
glycosidic bonds in pectin

Enzymatic inactivation through HPCD

Schematic diagram of the system used for HPCD
treatment



- 1: CO₂ supply
- 2: Syringe pump and controller
- 3: Cooling system
- 4: Rupture disc
- 5: High pressure vessel
- 6: Thermostatic bath
- 7: Magnetic stirrer
- 8: Sampling system

Treatment conditions

p (MPa)	8 - 30
T (°C)	20 - 45

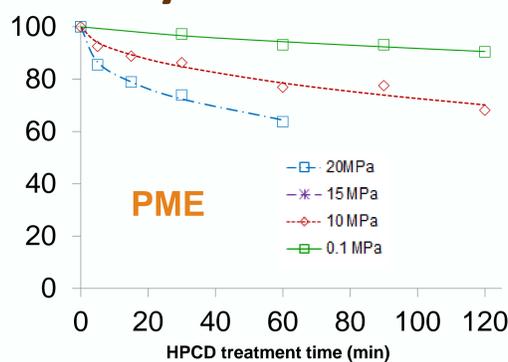
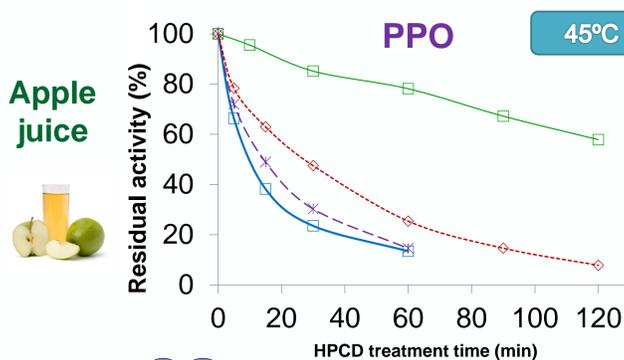
An alternative to heat treatment

HPCD TECHNOLOGY (High Pressure Carbon Dioxide)

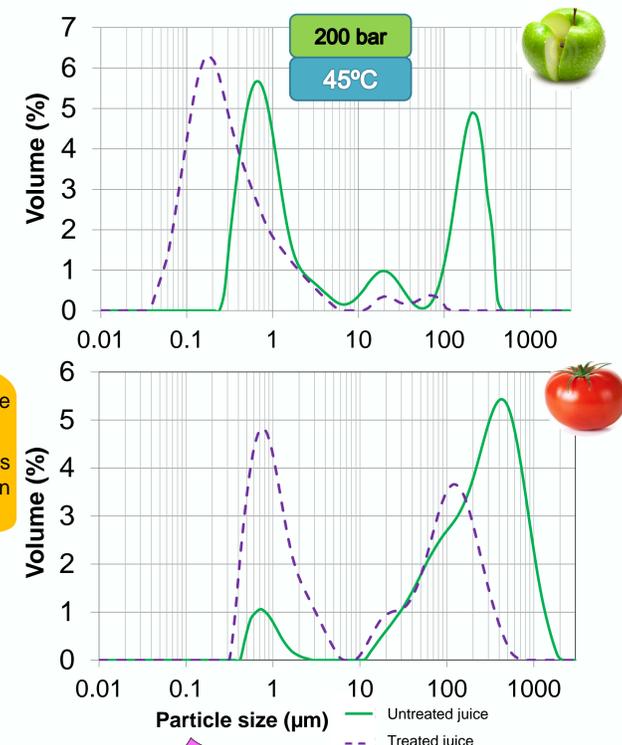
Is SC-CO₂ a green solvent?

- ✓ Nontoxic
- ✓ Nonflammable
- ✓ Readily available
- ✓ Easy to remove from product
- ✓ Renewable
- ✓ Recovered as a by-product

Residual activity of the enzymes



Particle size distribution



There is an increase in the number of smaller particles, while the size of the larger particles decreased, so HPCD seems to favour juice homogenization.

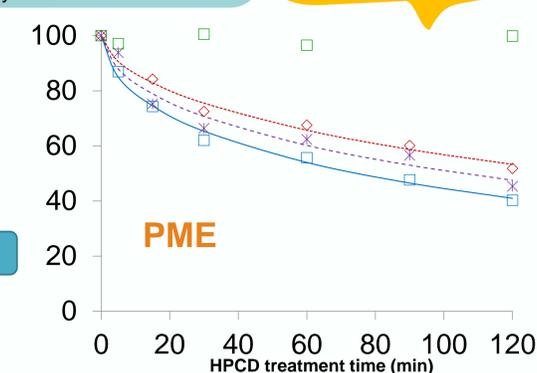
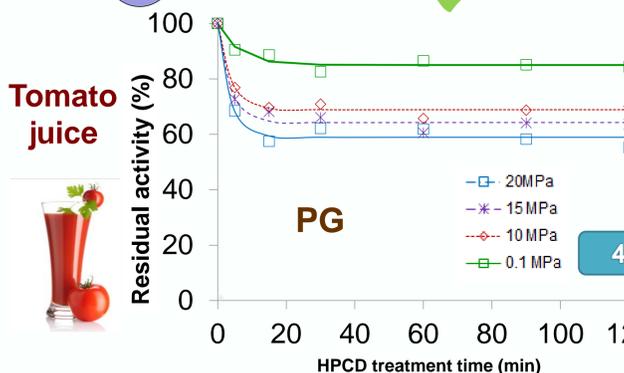
The solid line represents the Weibull model

Better inactivation after HPCD treatment than thermal treatment. As pressure increases, the residual activity of the enzymes decreases.

Although it's not represented here; Enzymatic inactivation increases with T due to the increase of CO₂ diffusivity that can accelerate the molecular collisions between CO₂ and enzymes.

Best inactivation results were observed in PPO activity.

PME from tomato juice was more sensitive to HPCD than PME from apple juice.



Concluding Remarks

- HPCD technology is a **clean alternative** to traditional heat treatments, and CO₂ can be considered a **green solvent**.
- This technology has demonstrated the **potential of inactivating the main enzymes** responsible for the deterioration of apple and tomato juice.
- HPCD is also capable of **favouring the homogenization of the product**, achieving a product of **higher quality** and better visual appearance, which presents greater appeal to the consumer.

References

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