Inactivation of polyphenoloxidase from *Litopenaeus vannamei* by High Pressure Carbon Dioxide (HPCD)

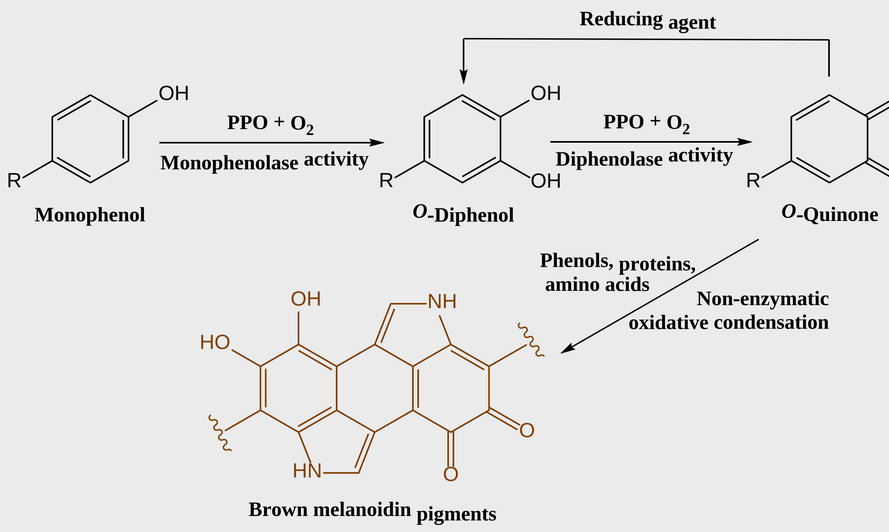
A.E. Illera[a], M.T. Sanz[a], L. Castro[a], O. Benito-Román[a], S. Beltrán[a], R. Melgosa[a] & C. Apetrei[a]

[a]*University of Burgos, Department of Biotechnology and Food Science. Chemical Engineering Division.* tersanz@ubu.es

[b]*Chemistry, Physics and Environment Department University of Galati, Romania*

Introduction: Melanosis in *Litopenaeus vannamei*

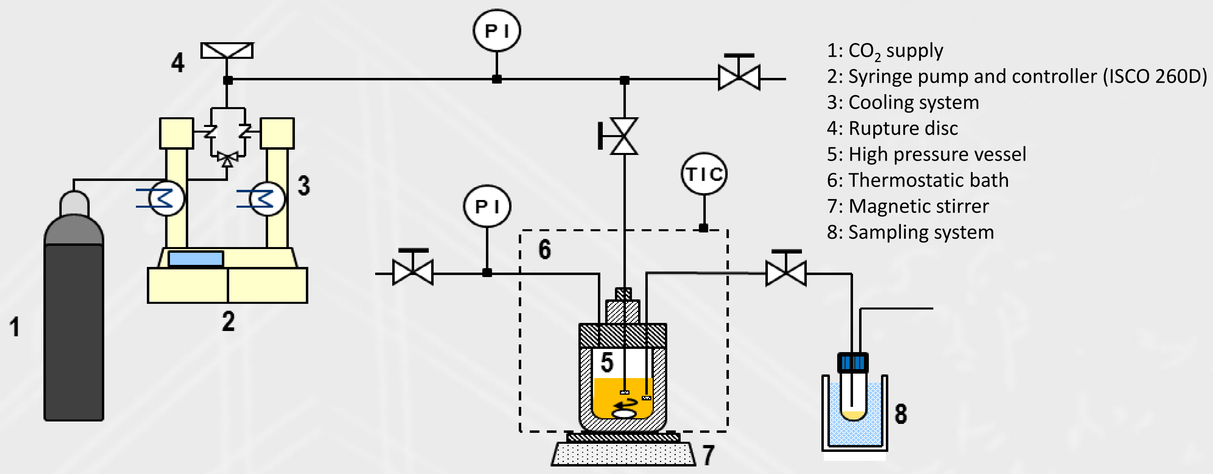
Mechanism of polyphenol oxidase (PPO)



To avoid melanosis in shrimps, sulphites are usually employed; however, their use is associated to allergies and asthmatic attacks.

In this work, the use of **HPCD is proposed as a cold pasteurization** method, with temperatures below 50 ^{o}C and pressures lower than 50 MPa.

Experimental section



1: CO_2 supply
2: Syringe pump and controller (ISCO 260D)
3: Cooling system
4: Rupture disc
5: High pressure vessel
6: Thermostatic bath
7: Magnetic stirrer
8: Sampling system

Preparation of a crude PPO extract: heads of *Litopenaeus vannamei* ➔ crushed with a blender and liquid N_2 in phosphate buffer (pH = 7.2) with 0.2 % Brij 35 ➔ filtered ➔ kept in freezing conditions until treatment and analysis.

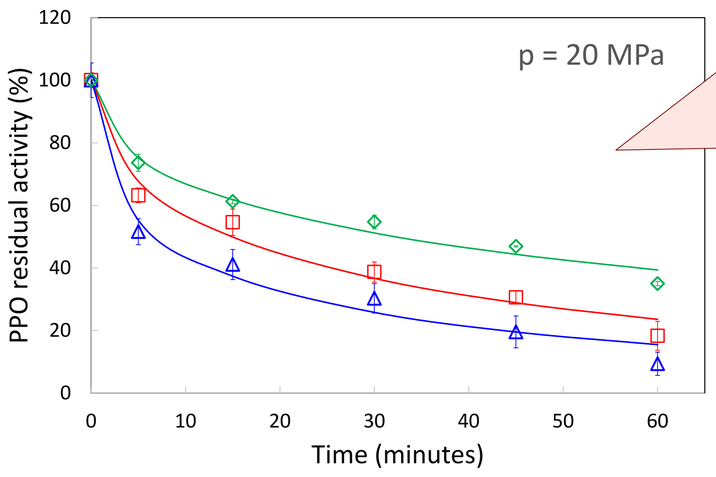
Determination of enzymatic inactivation kinetics of PPO extracts: Data fitted to the Weibull model

Treatment of whole shrimp pieces by HPCD: Determination of PPO activity of visual colour observation.

Results and discussion

Inactivation kinetic data of PPO extract

Inactivation kinetics of PPO extract by HPCD at different T
Lines represent the calculated values for the Weibull model.

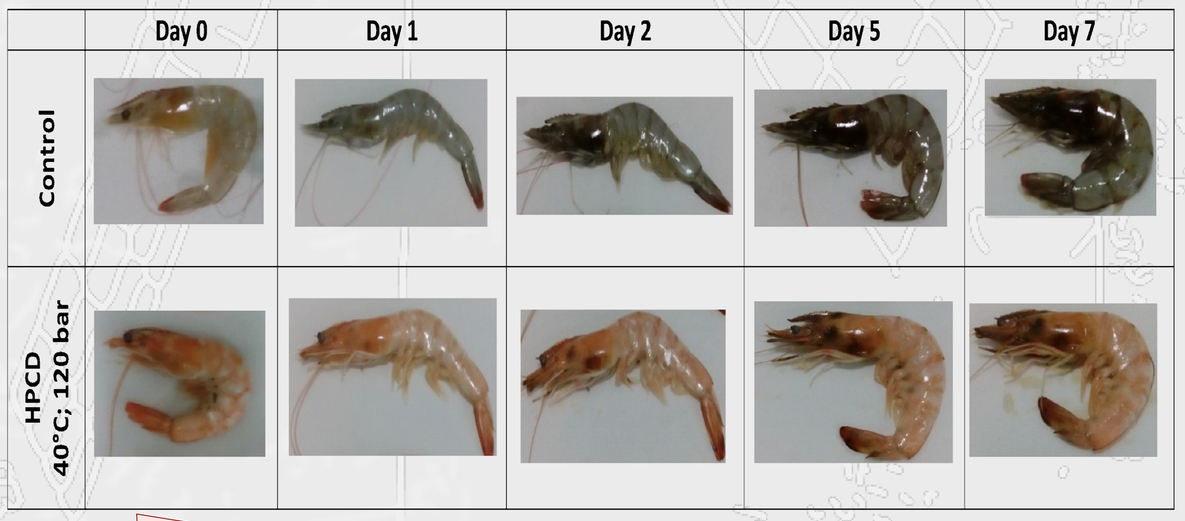


Faster inactivation at higher T: intrinsic effect of T and better transport properties of CO_2.

$$\log\frac{A}{A_O} = -\frac{1}{2.303}\left(\frac{t}{\alpha}\right)^{\beta} \qquad t_d = \alpha\left(-ln\left(10^{-d}\right)^{\frac{1}{\beta}}\right)$$

T, ^{o}C	α, min	β	R^2	$t_{d=1}$, min
35	69 ± 9	0.48 ± 0.06	0.984	399
40	30 ± 3	0.53 ± 0.07	0.982	145
50	16 ± 2	0.46 ± 0.07	0.984	95

PPO inactivation in whole shrimp pieces



Shrimps stored in plastic bag at 4 ^{o}C during 7 days:

- ✓ **Untreated shrimps** showed up browning in the cephalothorax after the second day.
- ✓ **HPCD treated shrimps** presented an aspect similar to cooked shrimps. Light browning in cephalothorax appeared in the fifth days.

PPO residual activity after HPCD and mild heating treatment (MH) at 40 ^{o}C. PPO was extracted at pH =7.2 with 0.2 % Brij 35 at 4 ºC.

Treatment	Mild heating	HPCD
PPO residual activity	83.3 %	Non detected

Literature:

[1] A. E. Illera et al. *J. Food Eng*. **2018**, 239, 64–71

[2] L. Zhou et al. Innov. Food Sci. Emerg. Technol. **2009**, 10, 321–327

Acknowledgements

- To MINECO and ERDF for financial support of AEI's contract through project CTA2015-64936-R
- To JCyL and ERDF for financial support of project BU301P18 and O. Benito-Román's post-doctoral contract.