

# Técnicas emergentes de procesado y estabilización.

**Antonio Morata**

Universidad Politécnica de Madrid

Spain

[antonio.morata@upm.es](mailto:antonio.morata@upm.es)

<https://blogs.upm.es/wineprof/antonio-morata/>

<https://www.researchgate.net/profile/Antonio-Morata>

<https://www.linkedin.com/in/antonio-morata-barrado-00b07a82/>

# Biotech/InstAnalysis/Emerging Tech



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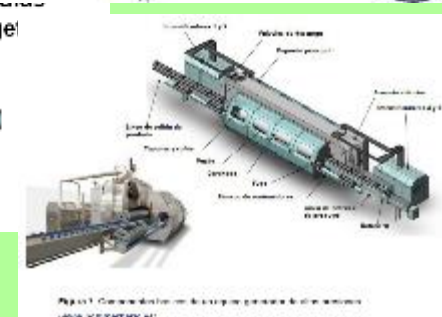
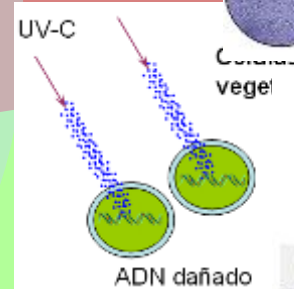
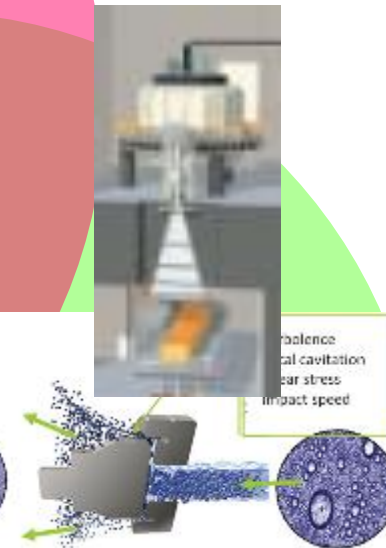
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## Análisis instrumental

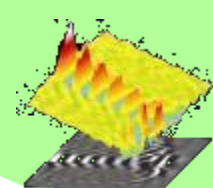


## Enología Biotecnologías de fermentación

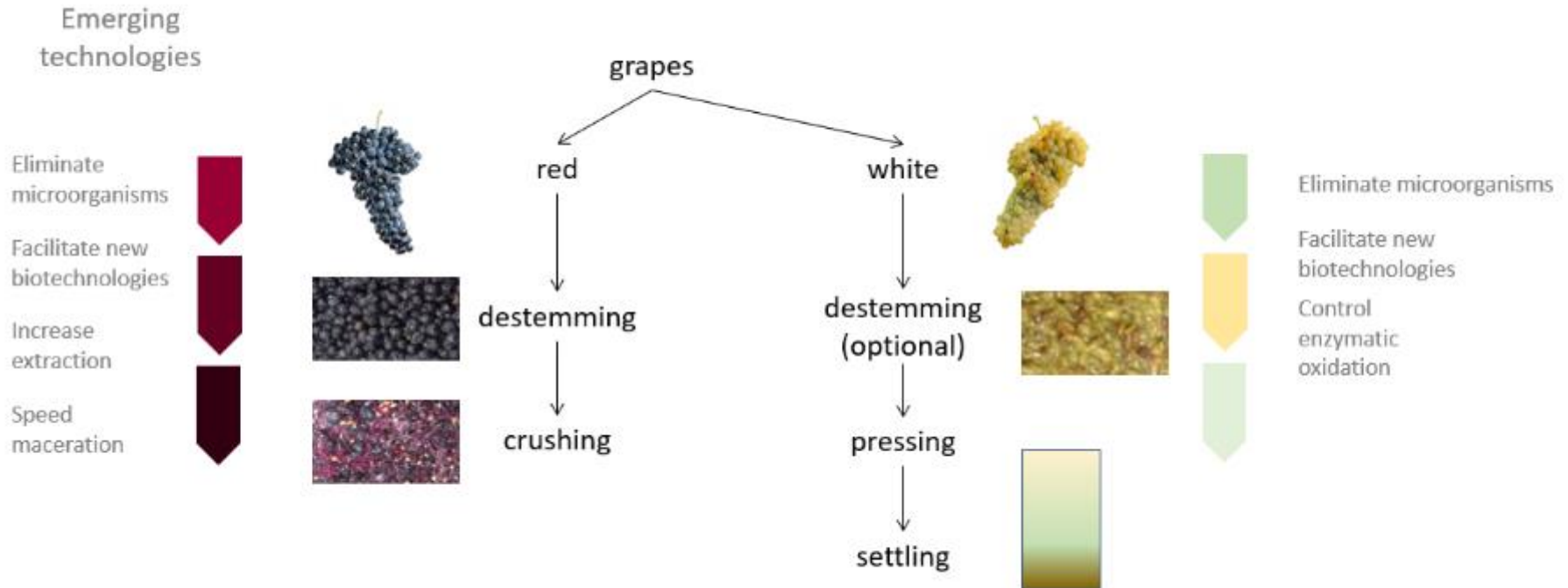
	YPD 37°C	1-lysin 9301	Nimix 9601	CBOMix Caudata
<i>Z. rourei</i>				
<i>M. pulcherrima</i>				
<i>C. rugosus</i>				
<i>S. bayanus</i>				
<i>S. cerevisiae</i>				
<i>H. uvarum</i>				
<i>K. fragilis</i>				
<i>Schizosaccharomyces sp.</i>				



## Técnicas emergentes



# Emerging technologies



HHP, UHPH, irradiation, PL, PEF, US

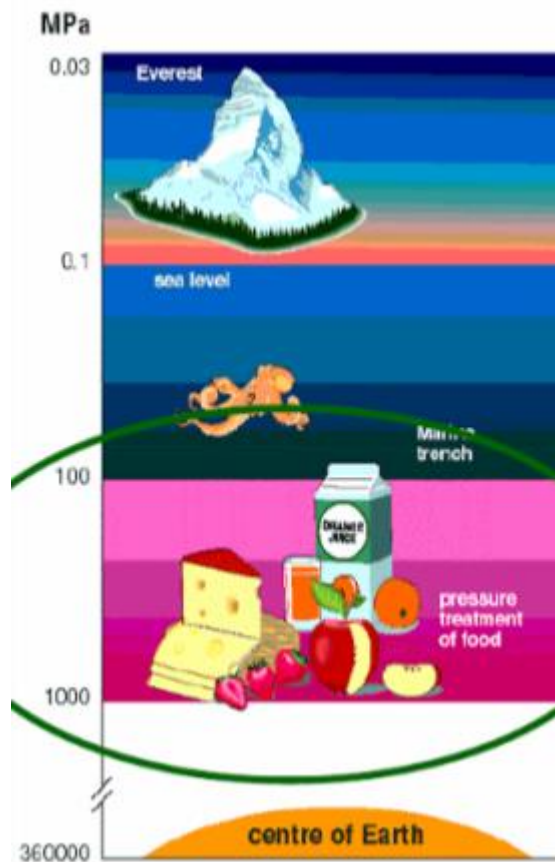


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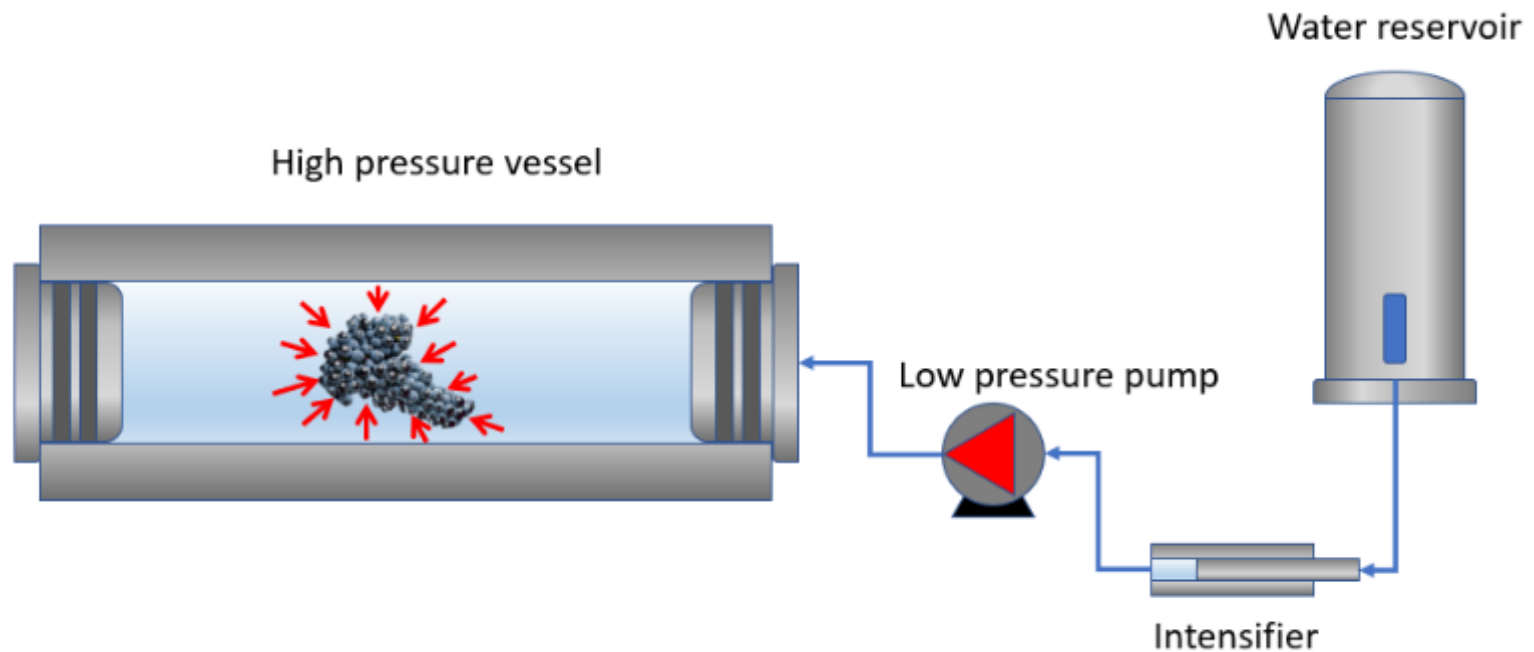
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# HHP. High hydrostatic pressure

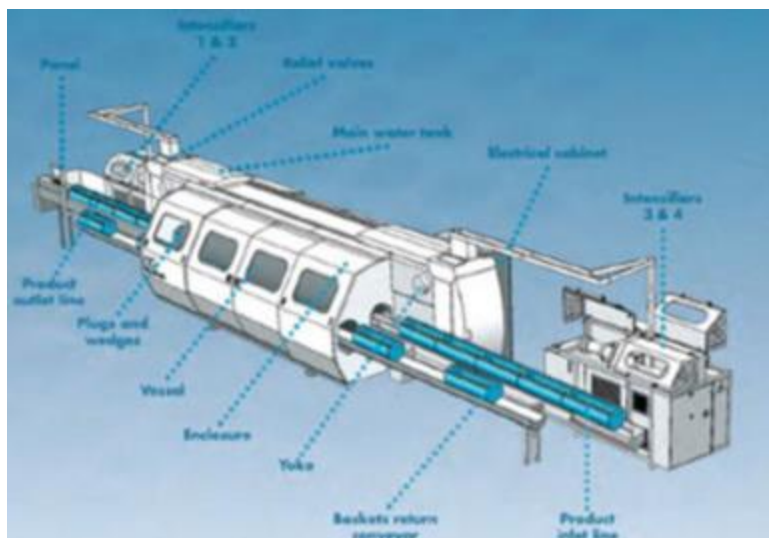


**HHP. 400-600 MPa  $\approx$  4000-6000 bar**

HPP is a non-thermal process that keep food under high hydrostatic pressure (transmitted by water) reaching up to 600 MPa



Presenta una capacidad de producción de hasta 50 equipos HPP por año. Existen más de 60 equipos industriales de altas presiones en producción distribuidos mundialmente. NC Hyperbaric ha instalado el 35% de los equipos de altas presiones en producción a nivel mundial, y el 80% desde 2005 (Figura 40).



[www.nchyperbaric.com](http://www.nchyperbaric.com)

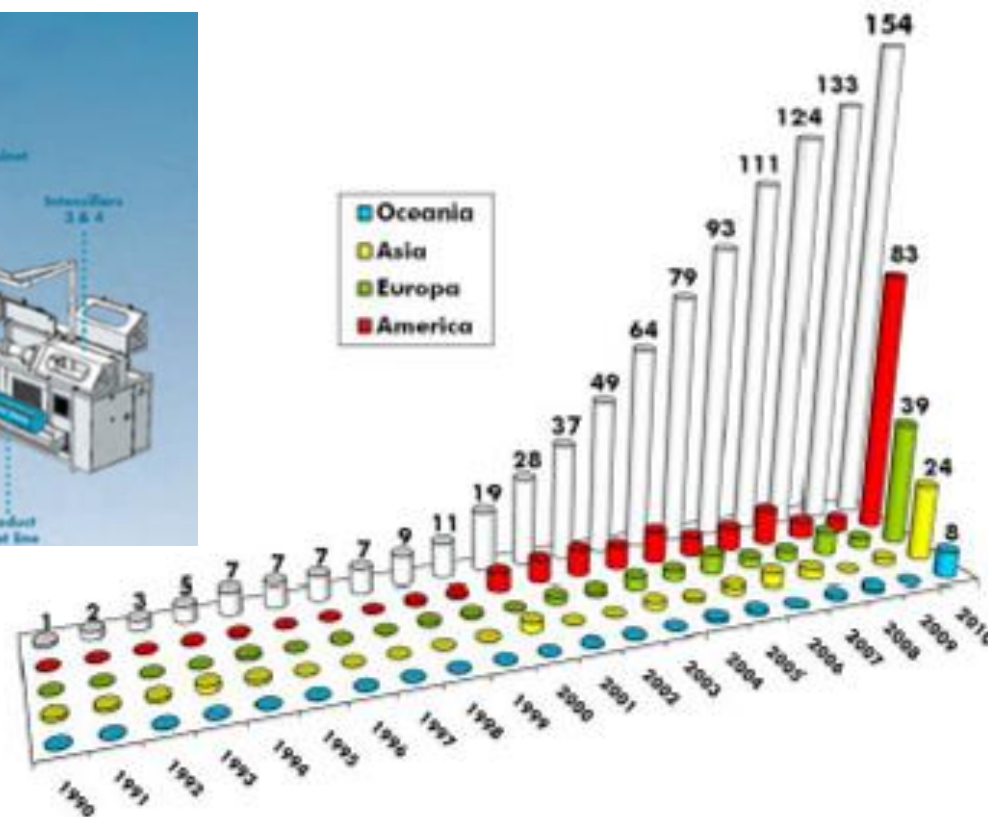
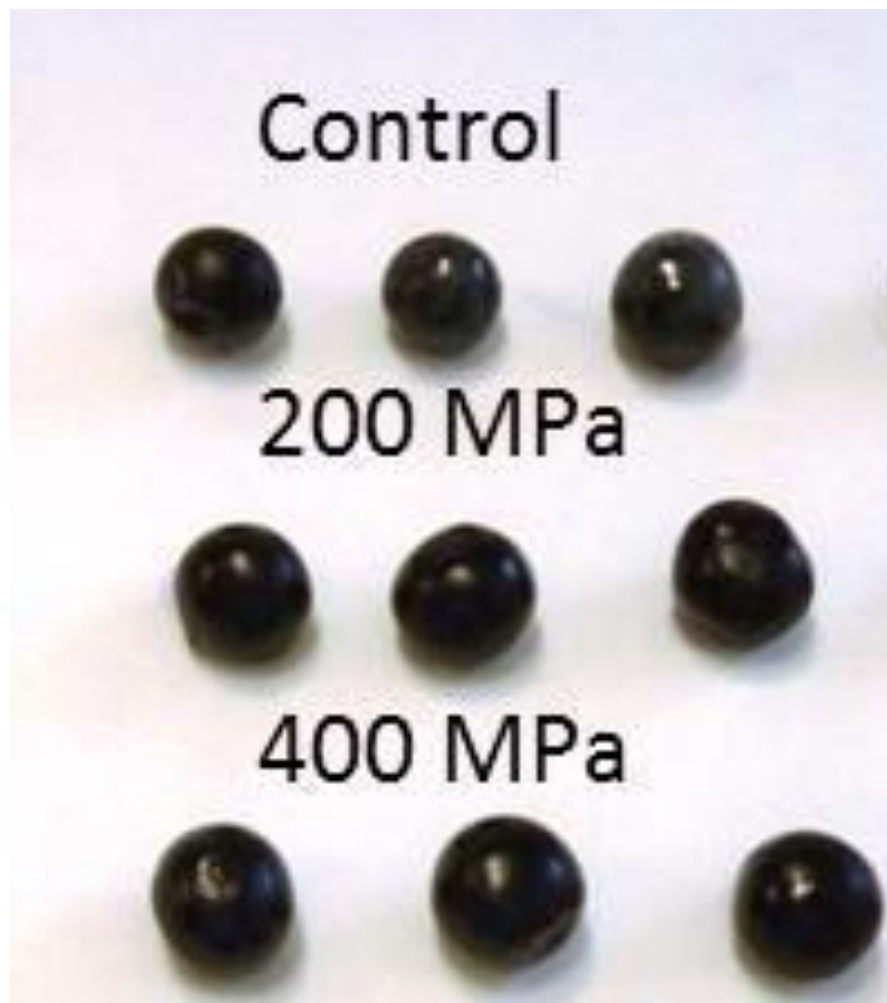


Figura 40. Número de equipos industriales versus año de instalación y continentes (NC Hyperbaric, 2010).

# Improving microbiological quality

## HHP.

- $\Delta T^a$  adiabatic compression 2-3 °C/100 MPa
- Pressurization do not affect covalent bonds. Protect sensory quality.



**External shape  
and color  
unaffected**

Morata, A., Loira, I., Vejarano, R., Bañuelos, M. A., Sanz, P. D., Otero, L., Suárez-Lepe, J. A. Grape Processing by High Hydrostatic Pressure: Effect on Microbial Populations, Phenol Extraction and Wine Quality. *Food Bioprocess Technol. Food and Bioprocess Technology* 2015, 8, 277-286.





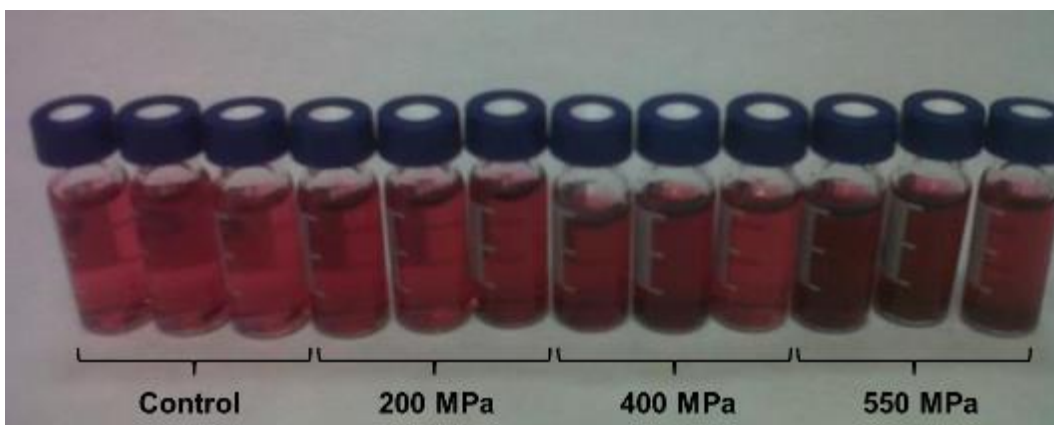
B

Control

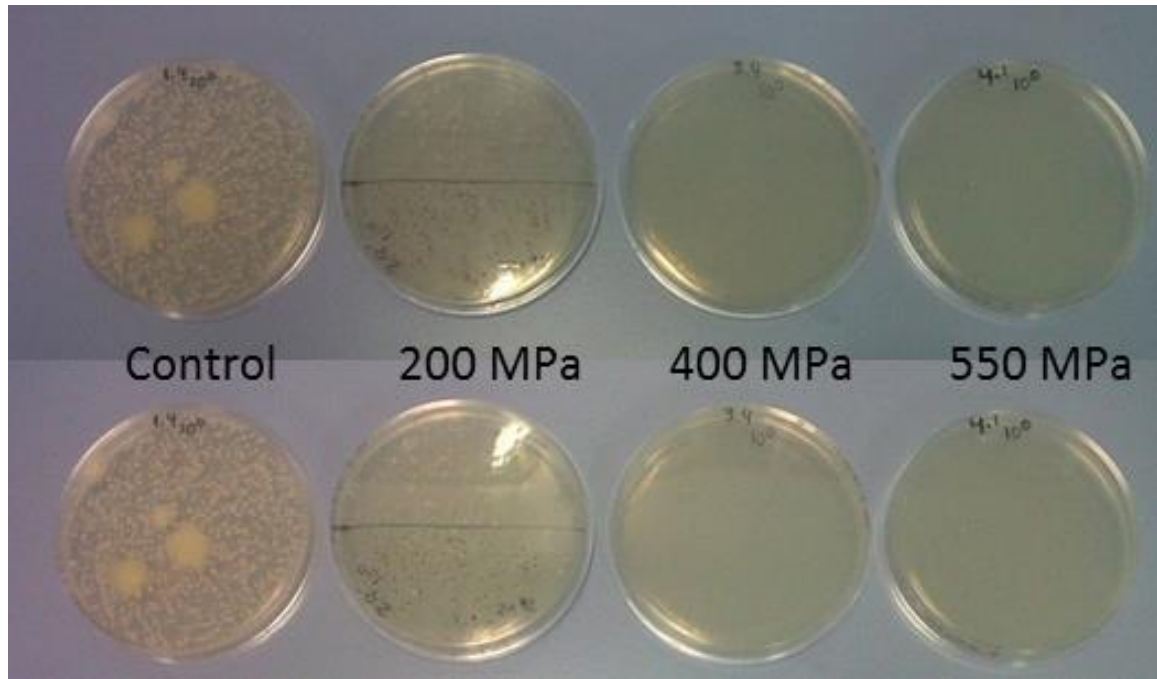
200 MPa

400 MPa

# Phenol extraction

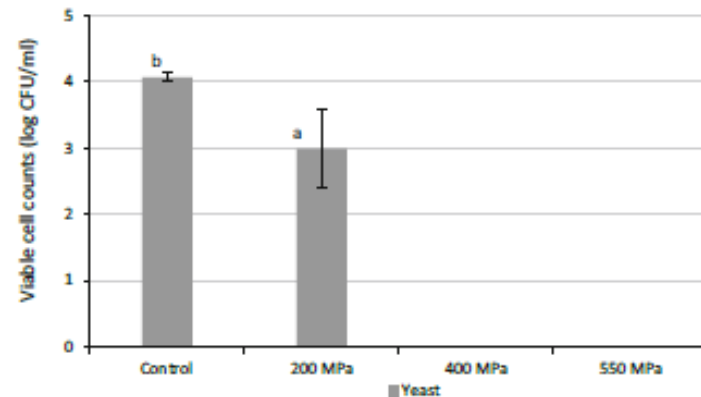


Morata, A., Loira, I., Vejarano, R., Bañuelos, M. A., Sanz, P. D., Otero, L., Suárez-Lepe, J. A. Grape Processing by High Hydrostatic Pressure: Effect on Microbial Populations, Phenol Extraction and Wine Quality. *Food Bioprocess Technol. Food and Bioprocess Technology* 2015, 8, 277-286.



Food Bioprocess Technol

Fig. 3 Microbial counts in crushed control and HHP-treated grapes at the beginning of fermentation. a Yeast, b Bacteria. Values are means  $\pm$  standard deviations of four replicates. Different letters in the same series indicate significant differences between means ( $p < 0.05$ )



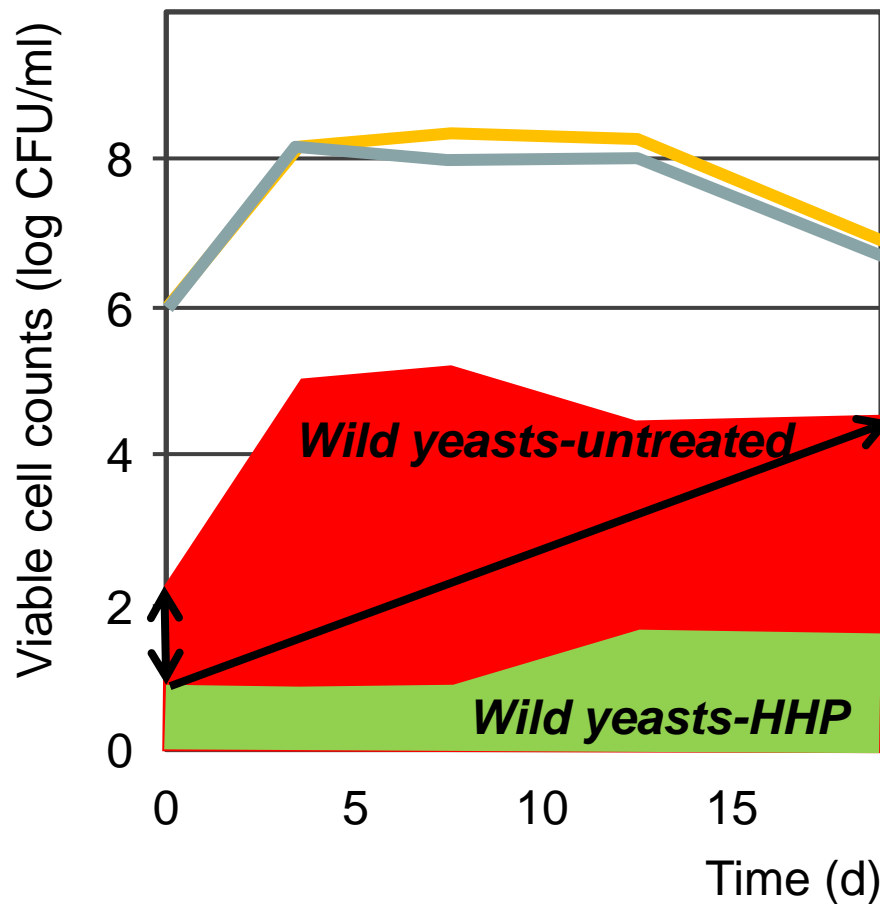
microbiological  
quality

Morata, A., Loira, I., Vejarano, R., Bañuelos, M. A., Sanz, P. D., Otero, L., Suárez-Lepe, J. A. Grape Processing by High Hydrostatic Pressure: Effect on Microbial Populations, Phenol Extraction and Wine Quality. Food Bioprocess Technol. Food and Bioprocess Technology 2015, 8, 277-286.

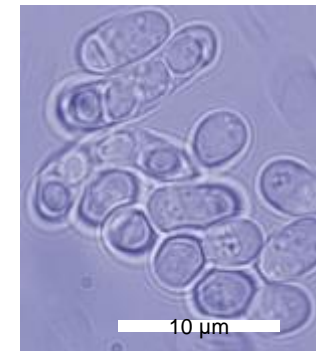
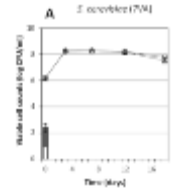
# HHP & non-*Saccharomyces*

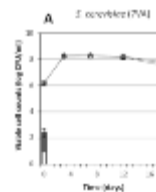


## *Schizosaccharomyces pombe*

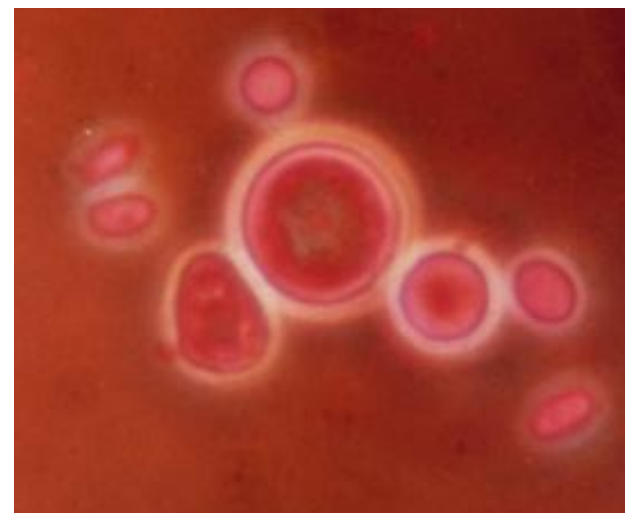
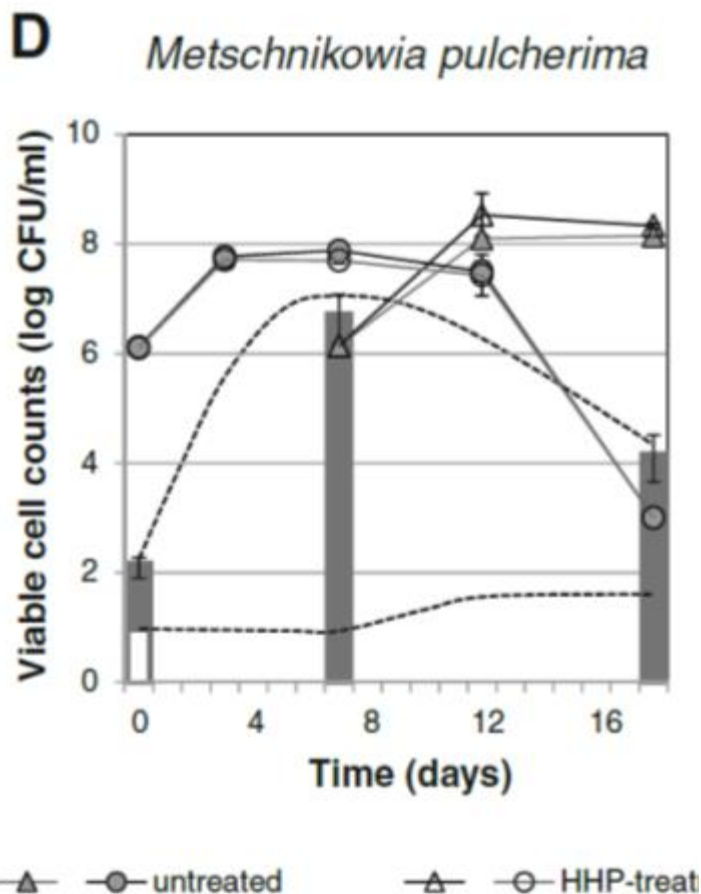


*S. pombe* untreated  
*S. pombe* HHP





# *Metschnikowia pulcherrima*



Food Bioprocess Technol (2016) 9:1769–1778  
 DOI 10.1007/s11947-016-1760-8

ORIGINAL PAPER

## Grape Processing by High Hydrostatic Pressure: Effect on Use of Non-*Saccharomyces* in Must Fermentation

María Antonia Bañuelos<sup>1</sup> · Iris Loira<sup>2</sup> · Carlos Escott<sup>2</sup> · Juan Manuel Del Fresno<sup>2</sup> · Antonio Morata<sup>2</sup> · Pedro D. Sanz<sup>3</sup> · Laura Otero<sup>3</sup> · Jose Antonio Suárez-Lepe<sup>2</sup>

# UHPH. Ultra High-Pressure Homogenization

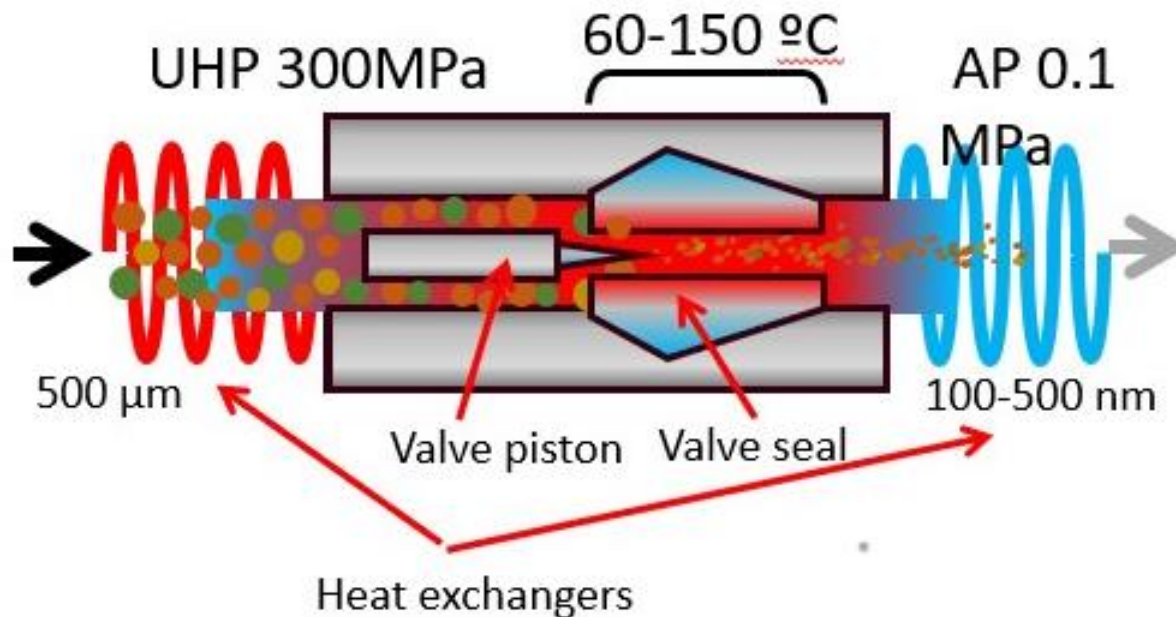


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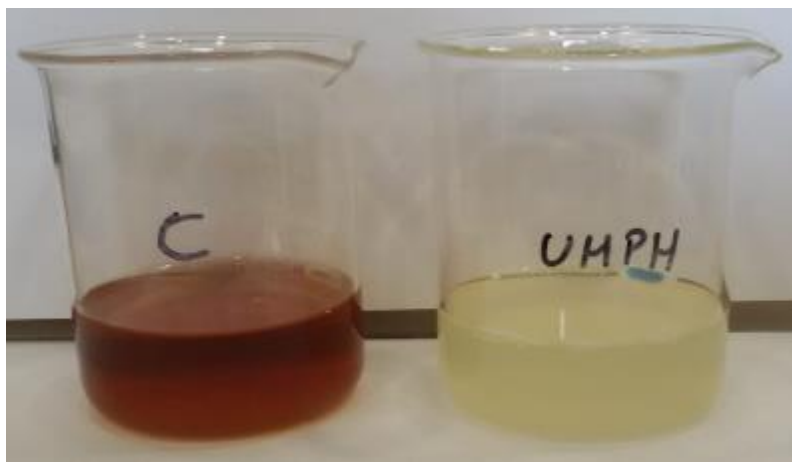


## YPSICON valve $P > 300 \text{ MPa}$



3x sound speed (Mach 3)

- Pasteurization/sterilization
- Nano-fragmentation
- Enzyme inactivation
- Nano-covering
- Nano-encapsulation



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Food Chemistry 332 (2020) 127417

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White wine processing by UHPH without SO<sub>2</sub>. Elimination of microbial populations and effect in oxidative enzymes, colloidal stability and sensory quality



M<sup>a</sup> Antonia Bañuelos<sup>a</sup>, Iris Loira<sup>b</sup>, Buenaventura Guzmán<sup>c</sup>, Carlos Escott<sup>b</sup>, Juan Manuel Del Fresno<sup>b</sup>, Idina Cadina-Torrella<sup>d</sup>, Joan Miquel Quevedo<sup>d</sup>, Ramon Gervilla<sup>d</sup>, Jesús María Rodríguez Chavarría<sup>e</sup>, Sergi de Lamo<sup>e</sup>, Raúl Ferrer Gallego<sup>d</sup>, Rocío Álvarez<sup>e</sup>, Carmen González<sup>b</sup>, José Antonio Suárez-López<sup>b</sup>, Antonio Morata<sup>b,\*</sup>

Food Chemistry 332 (2020) 127417

M.A. Bañuelos, et al.

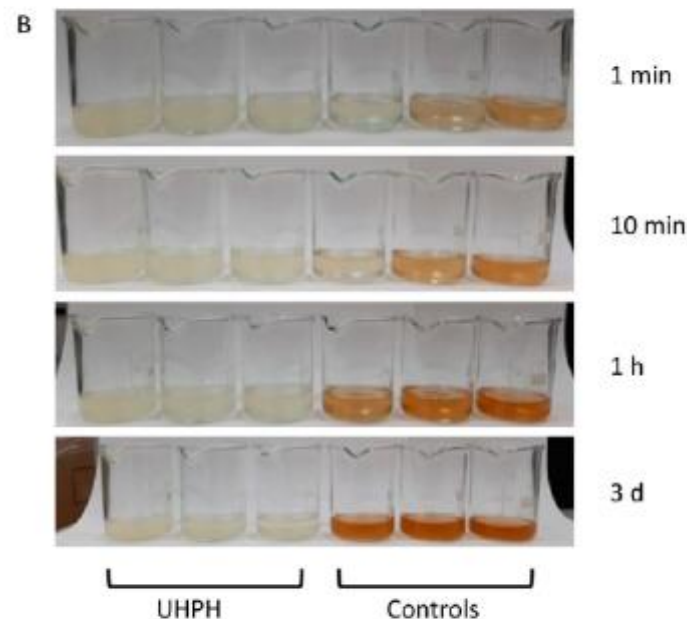
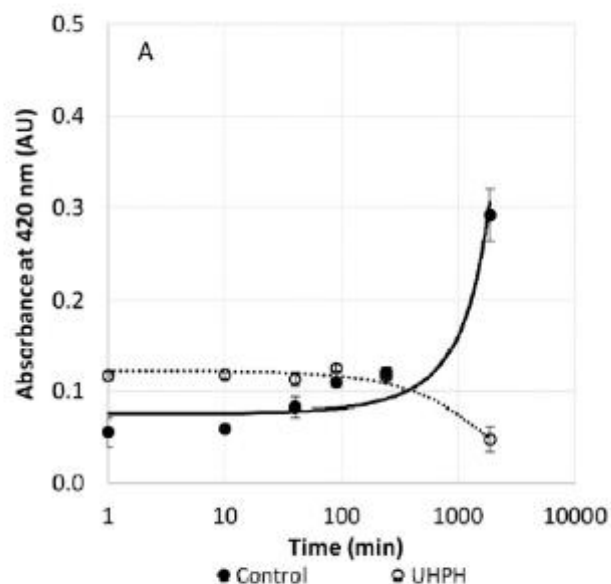
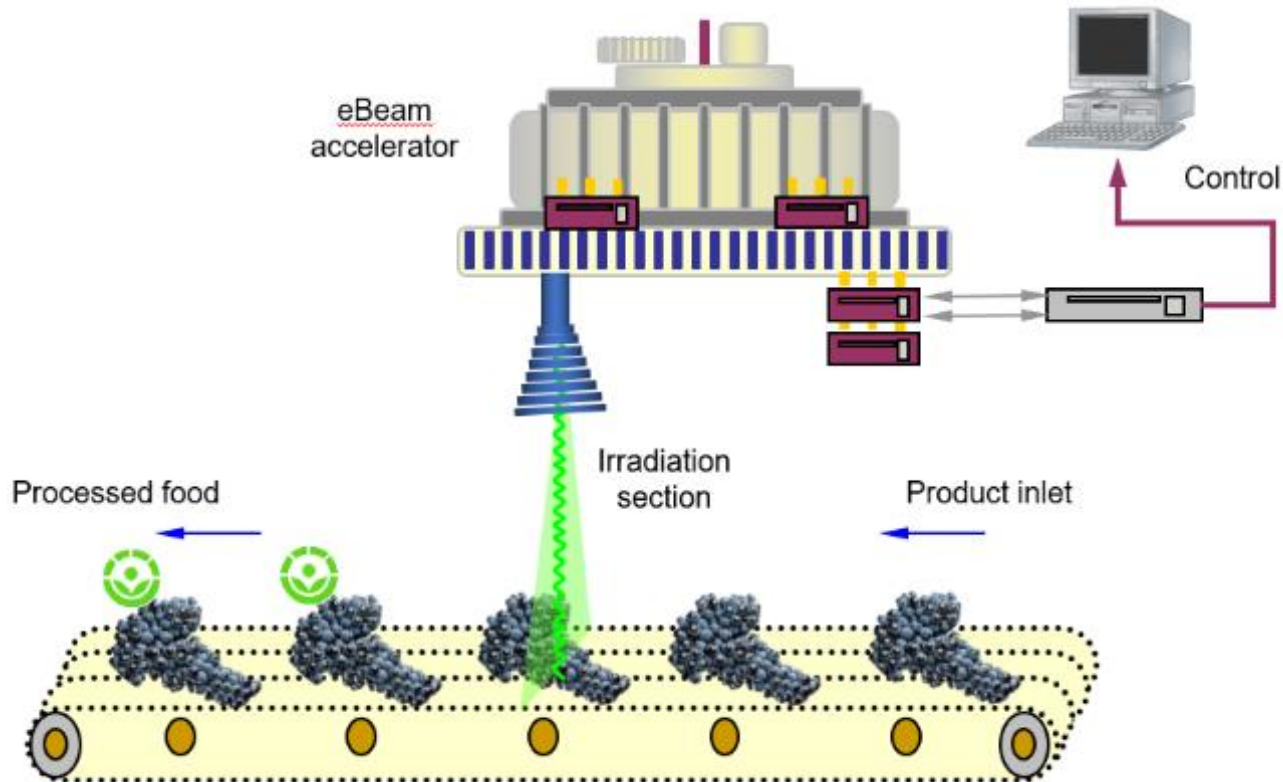


Fig. 2. Absorbance at 420 nm in control and UHPH-processed musts (a) and colour changes by enzymatic oxidative browning in triplicate (b), UHPH-processed (left) and controls (right).

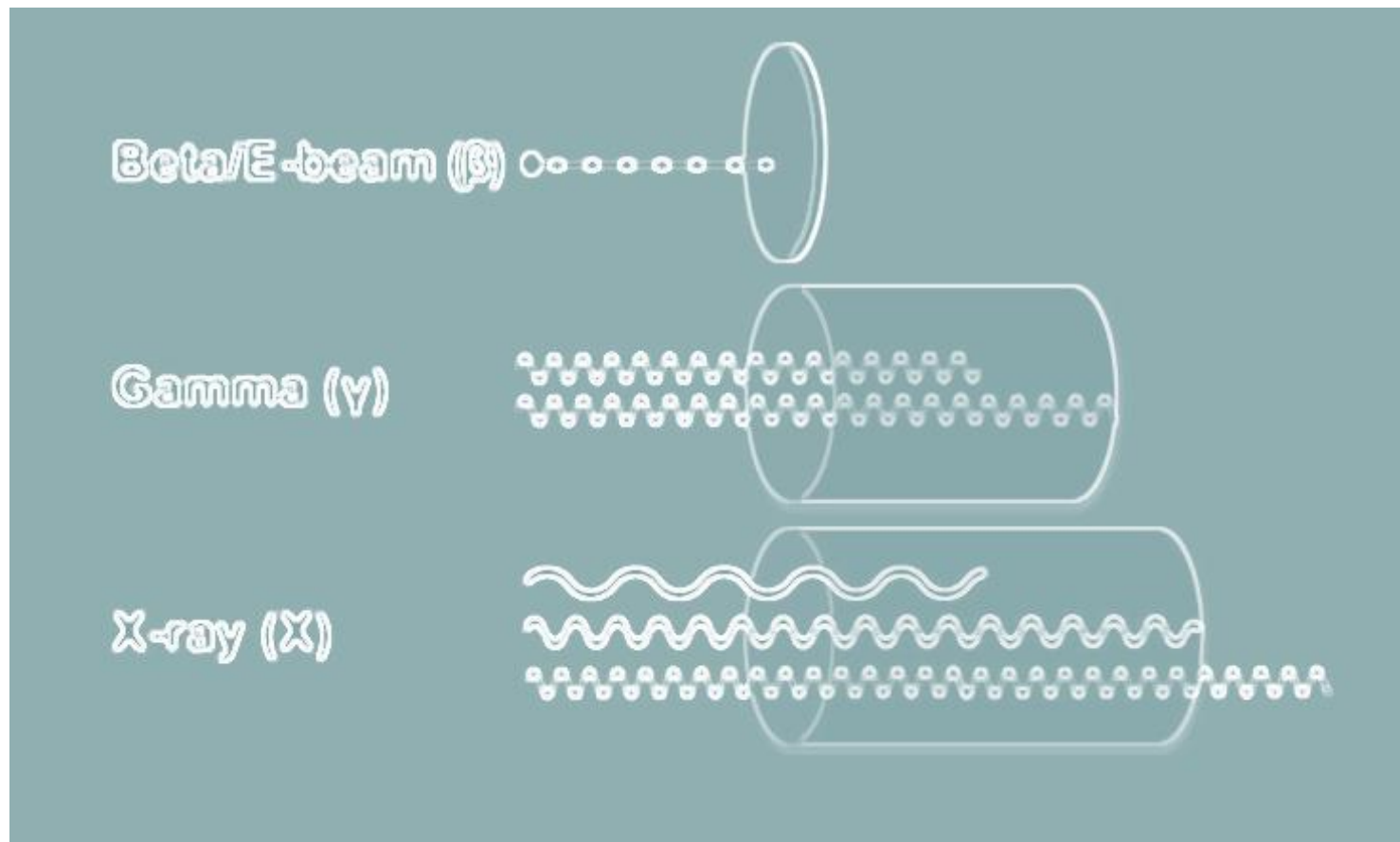
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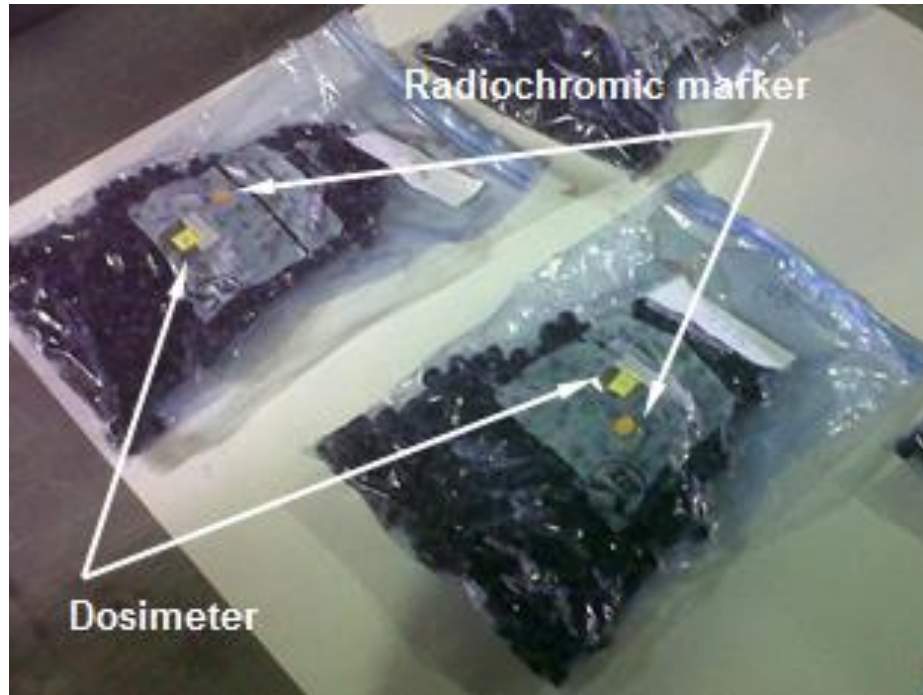




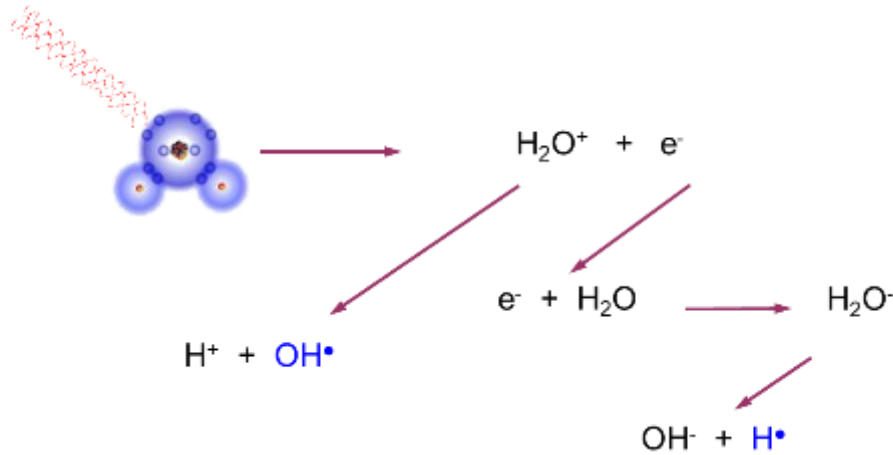
## e-beam irradiation



# e-beam irradiation



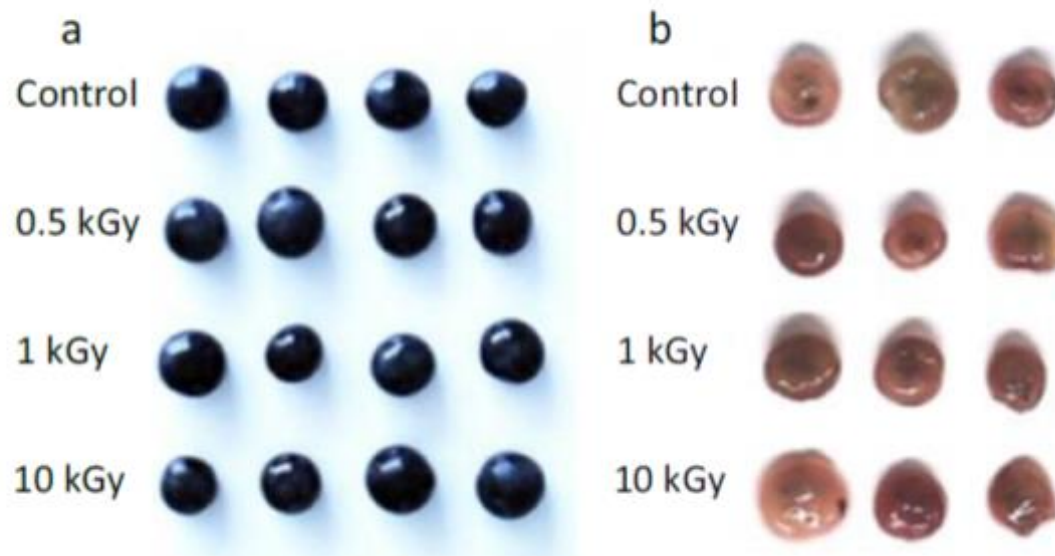
Radiación  
ionizante



# e-beam irradiation

Food Bioprocess Technol

**Fig. 1** Appearance of irradiated grapes. **a** External surface. **b** Peeled



Food Bioprocess Technol  
DOI 10.1007/s11947-015-1540-x

ORIGINAL PAPER

## Electron Beam Irradiation of Wine Grapes: Effect on Microbial Populations, Phenol Extraction and Wine Quality

Antonio Morata<sup>1</sup> · María Antonia Bañuelos<sup>2</sup> ·  
Wendu Tesfaye<sup>1</sup> · Iris Loira<sup>1</sup> · Felipe Palomero<sup>1</sup> ·  
Santiago Benito<sup>1</sup> · María Jesús Callejo<sup>1</sup> · Ana Villa<sup>2</sup> ·  
M. Carmen González<sup>1</sup> · Jose Antonio Suárez-Lepe<sup>1</sup>



# e-beam irradiation

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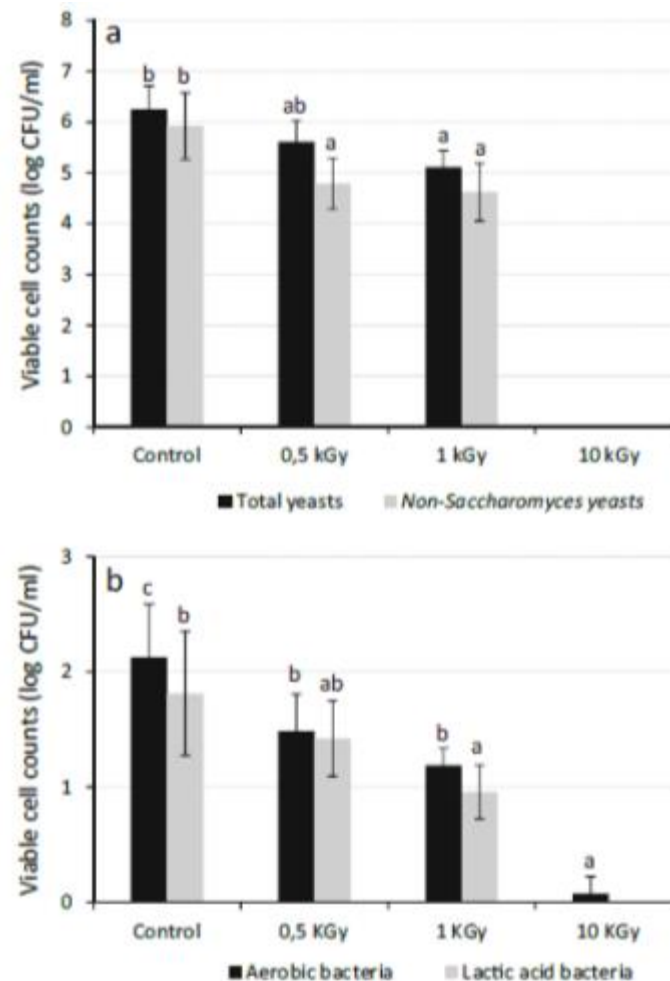
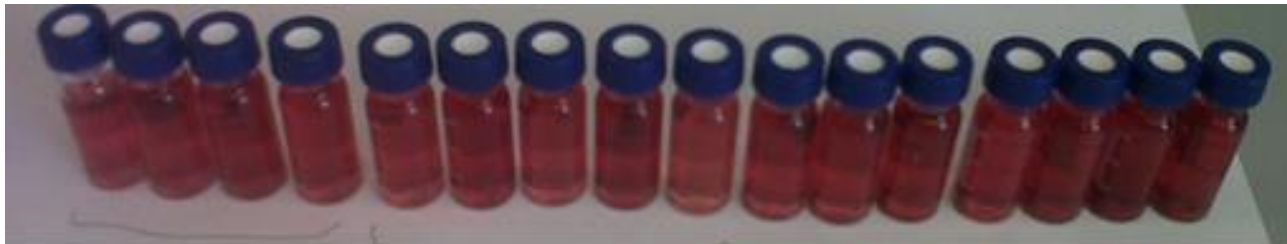


Fig. 2 Microbial counts (viable cells) in the must from crushed control and irradiated grapes (log cfu/mL). a Yeasts. b Bacteria. Different letters in the same series indicate significant differences between means ( $p < 0.05$ )

## e-beam irradiation



**Control**

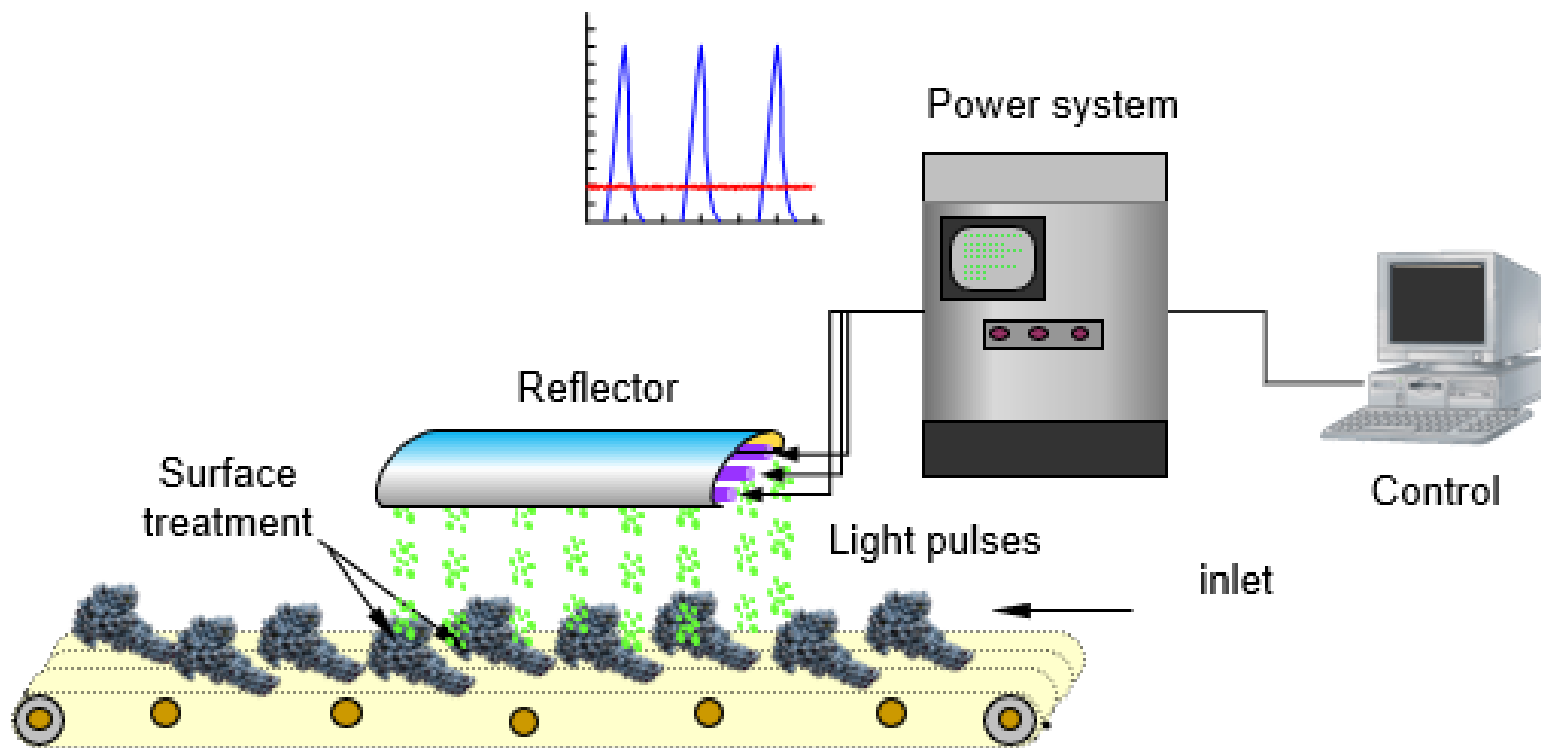
**0,5 kGy**

**1 kGy**

**10 kGy**

# Pulsed Light

Pulsed light intensity and frequency



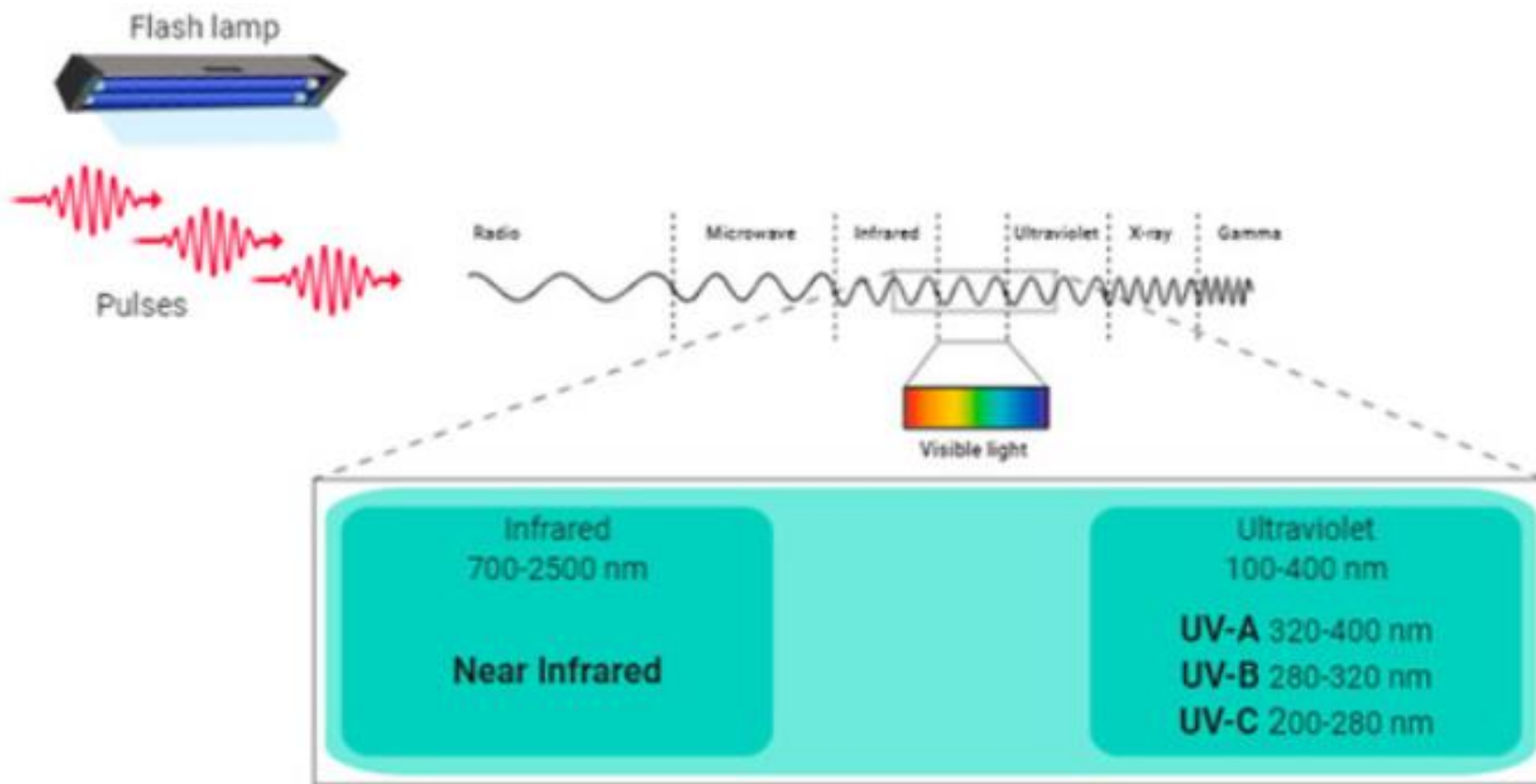


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# Pulsed Light



<https://doi.org/10.3390/beverages6030045>



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## Pulsed Light: Challenges of a Non-Thermal Sanitation Technology in the Winemaking Industry

by Altana Santamara <sup>1,2</sup>, Carlos Escott <sup>1,2</sup>, Iris Lohr <sup>1,2</sup>, Juan Manuel del Fresno <sup>1,2</sup>, Carmen González <sup>1,2</sup> and Antonio Marín <sup>1,2</sup> 

EnotecUPM, Chemistry and Food Technology Department, Universidad Politécnica de Madrid, Avenida Pío de Heredia 2, 28042 Madrid, Spain

# Pulsed Light

A



Treatment conditions

Grapes cut in half

Height: 7 cm

Fluence: 0.9 J/cm<sup>2</sup>

Power: 1 MW

Pulses: 5

Pulse duration: 0.2–2 ms

B

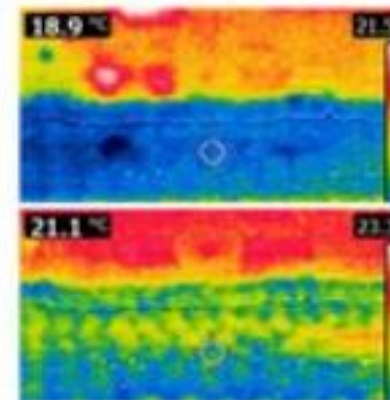


Double xenon lamps

Height

Irradiation area

C



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## Improvement of Must Fermentation from Late Harvest cv. Tempranillo Grapes Treated with Pulsed Light

by Carlos Escott<sup>1</sup>, Carmen López<sup>1</sup>, Iris Loira<sup>1</sup>, Carmen González<sup>1</sup>, María Antonia Bañuelos<sup>2</sup>, Wendu Tesfaye<sup>1</sup>, José Antonio Suárez-Lepe<sup>1</sup> and Antonio Morata<sup>1</sup>

<https://doi.org/10.3390/foods10061416>

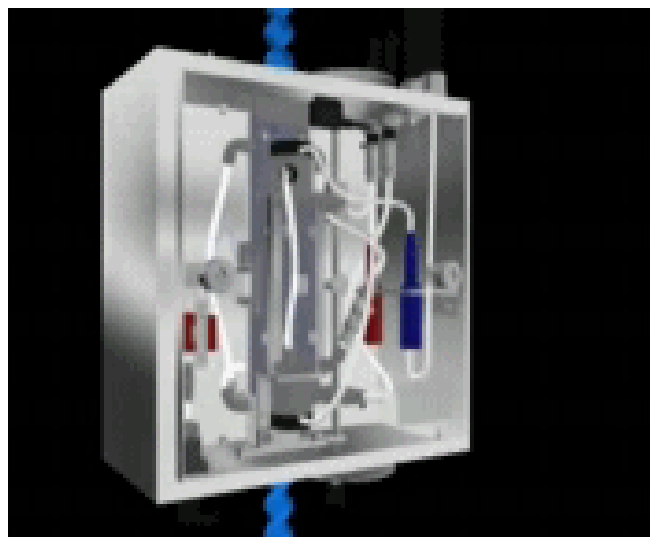
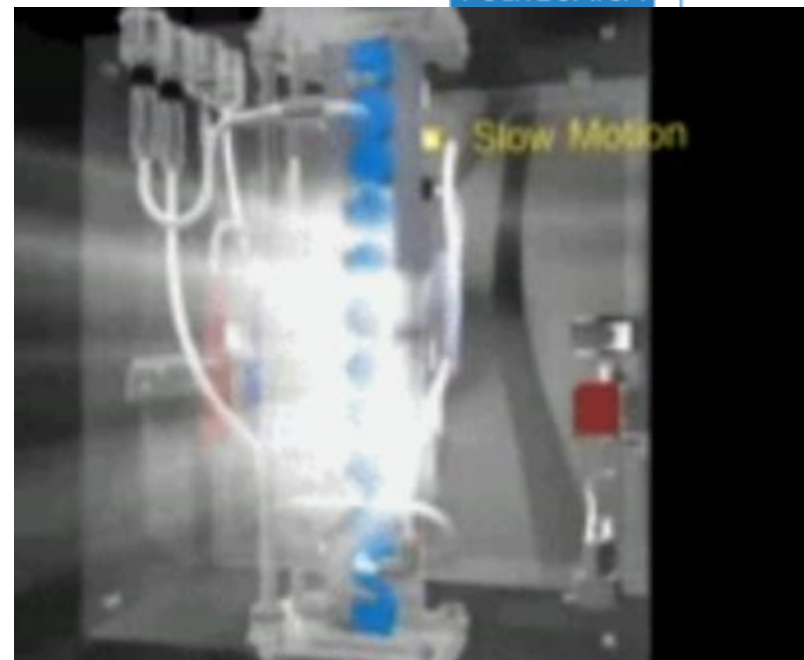
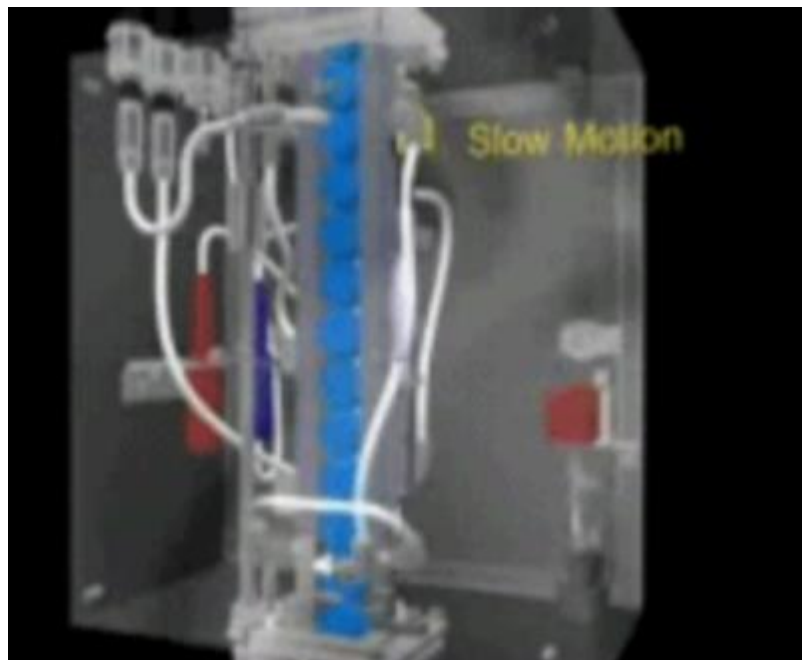


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## Pulsed Light

Control

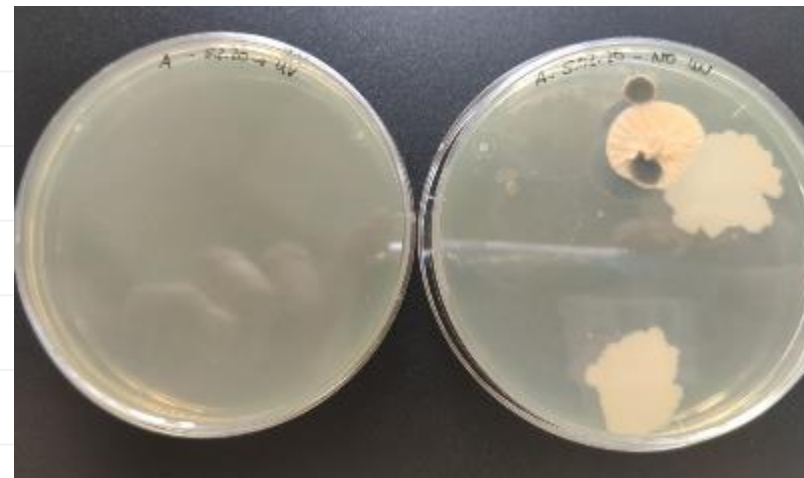
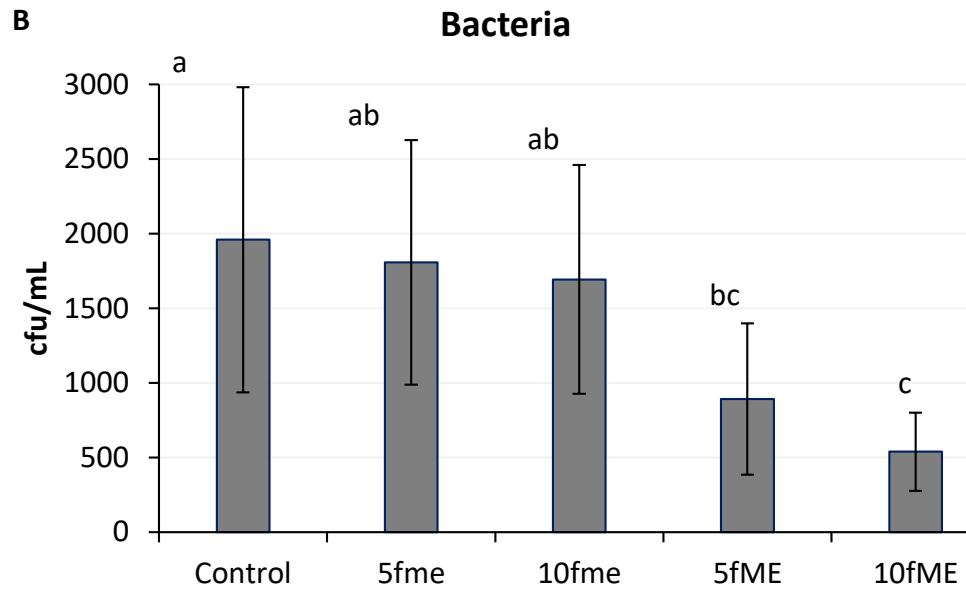
5 pulses

10 pulses



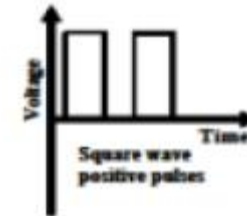
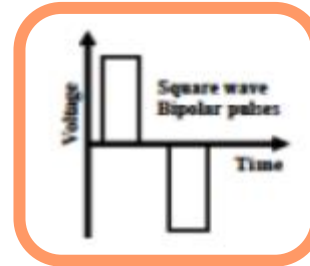
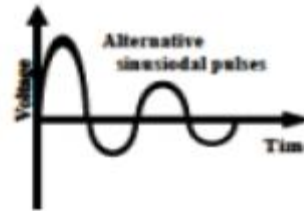
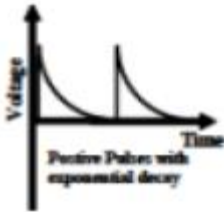


# Pulsed Light





# Pulsed electric fields



10-40 kV/cm

40-60A

us

## Pulsed electric fields

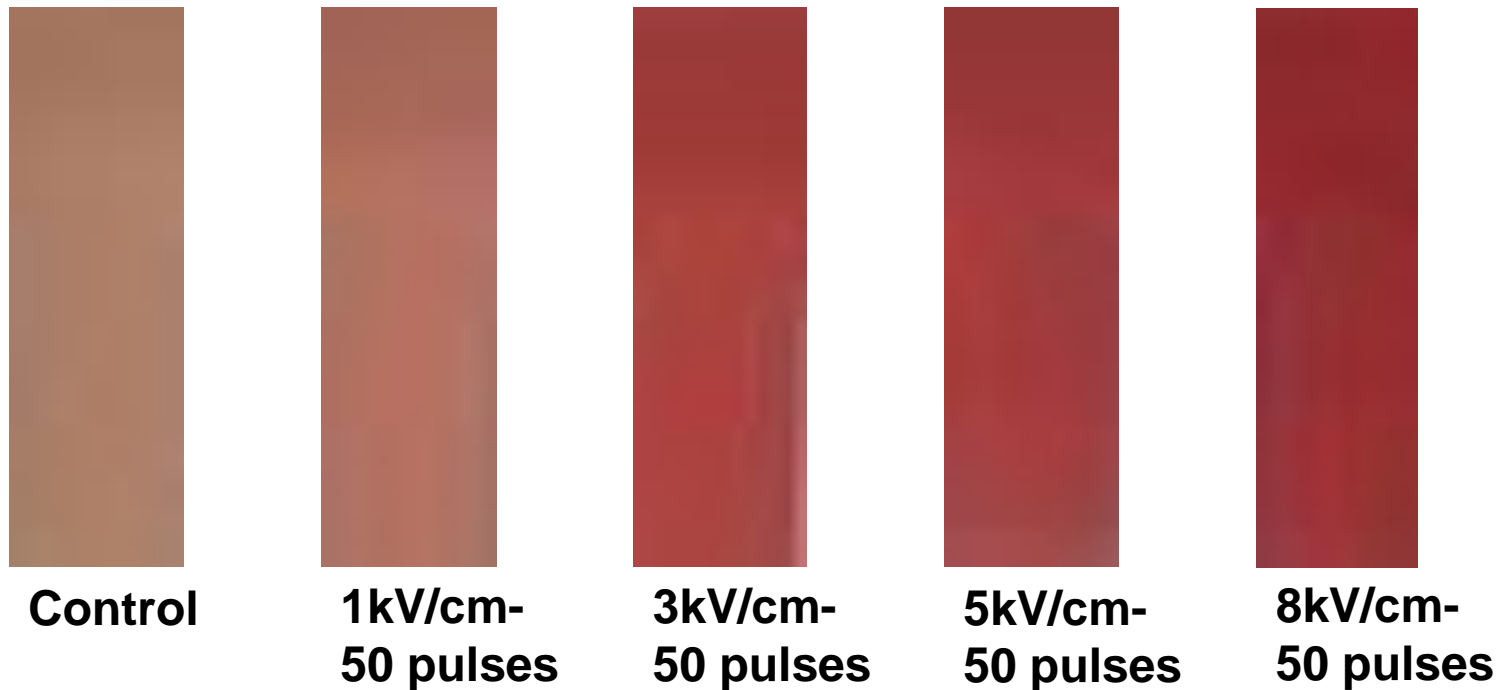
Effects of antimicrobials with and without pulsed electrical field (PEF) treatment on microbial reduction (log values) in white grape juice at 50 °C (4–8 replications, 65 kV/cm field, peak-to-peak, and 4 mm electrode gap)

<i>Treatments</i>	<i>Microbial log reductions, mean and standard deviation</i>
Control, no pulse	1.5±1.1 <sup>a</sup>
20 pulses	4.0±0.3 <sup>b</sup>
30 pulses	4.1±0.2 <sup>b</sup>
40 pulses	4.2±0.5 <sup>b</sup>

Wu, Y., Mittal, G. S., Griffiths, M. W. 2005. Effect of Pulsed Electric Field on the Inactivation of Microorganisms in Grape Juices with and without Antimicrobials. *Biosystems Engineering*, 90, 1-7

# Pulsed electric fields

**Maceration time: 1 hour**  
**Low temperature**



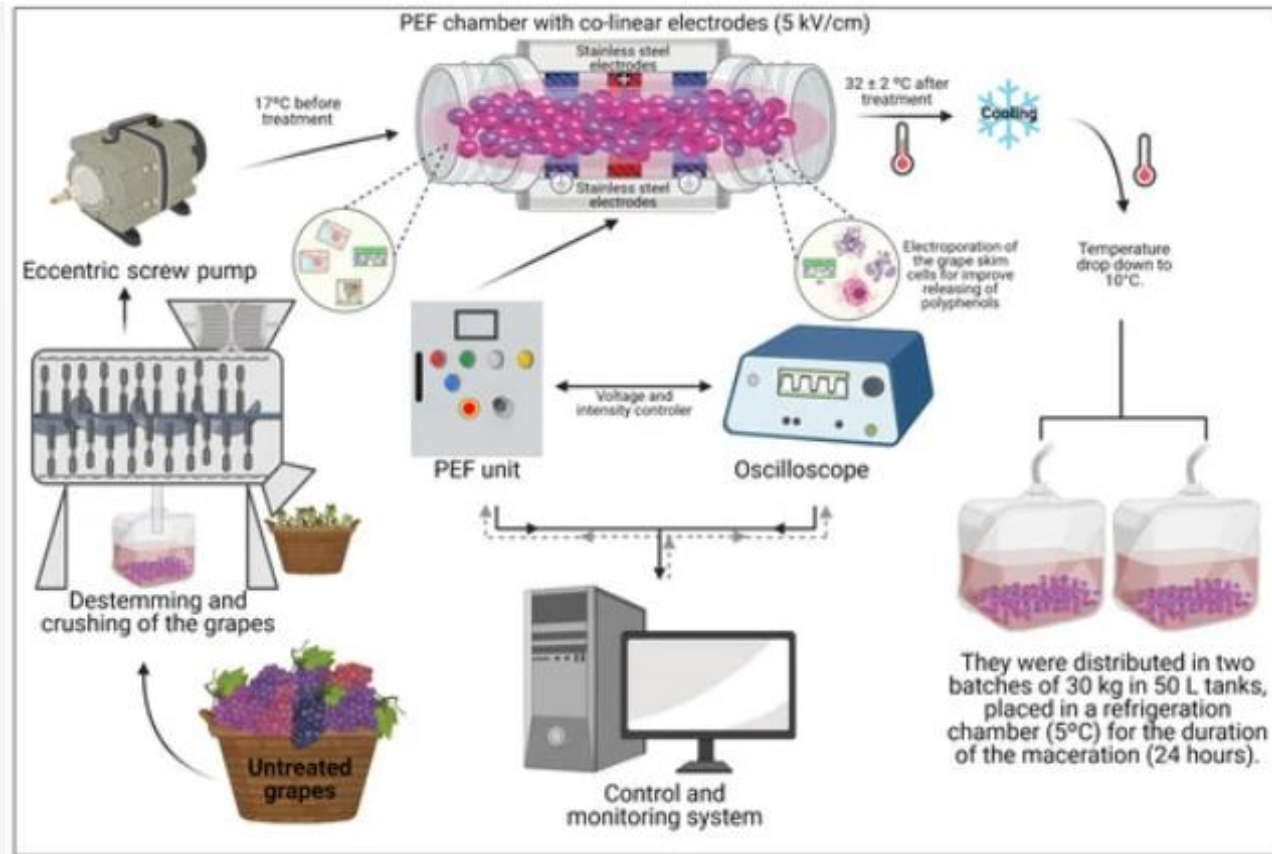
# Pulsed electric fields



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## Pulsed Electric Fields to Improve the Use of Non-Saccharomyces Starters in Red Wines

by Cristian Wehario<sup>1</sup>, Iris Lora<sup>1</sup>, Javier Roso<sup>2</sup>, Ignacio Álvarez<sup>2</sup>,  
Carola Delso<sup>2</sup> and Antonio Morata<sup>1</sup>

<sup>1</sup> Unidad IFM, Chemistry and Food Technology Department, ETSIAB, Universidad Politécnica de Madrid, Avenida Puerta de Hierro 2, 28040 Madrid, Spain

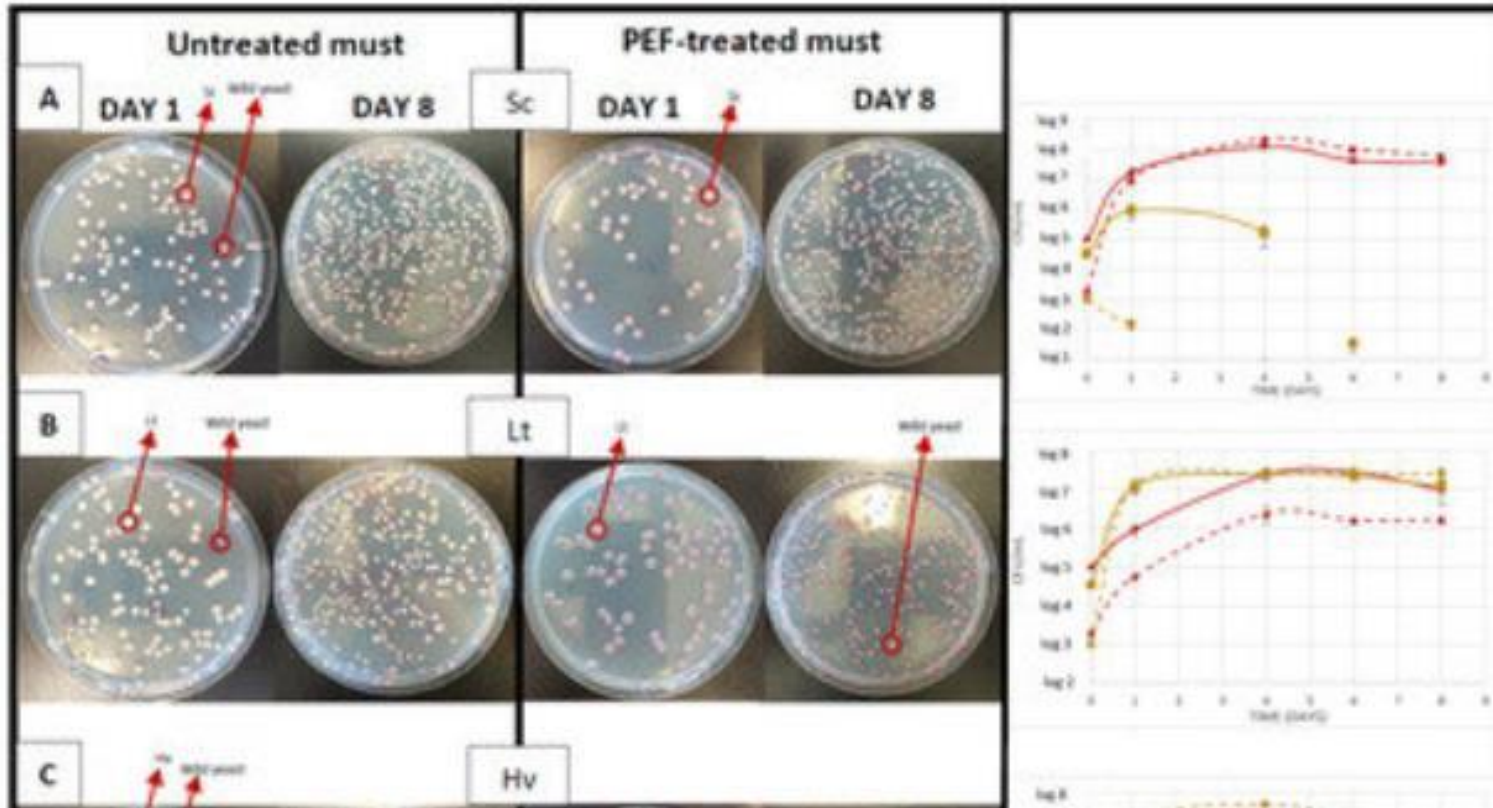
<https://doi.org/10.3390/foods10071472>

# Pulsed electric fields



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## Pulsed Electric Fields to Improve the Use of Non-Saccharomyces Starters in Red Wines

by Cristian Weigero <sup>1</sup>, Iris Lora <sup>1</sup>, Javier Ruiz <sup>2</sup>, Ignacio Álvarez <sup>2</sup>, Carlota Delso <sup>2</sup> and Antonio Morata <sup>1</sup>

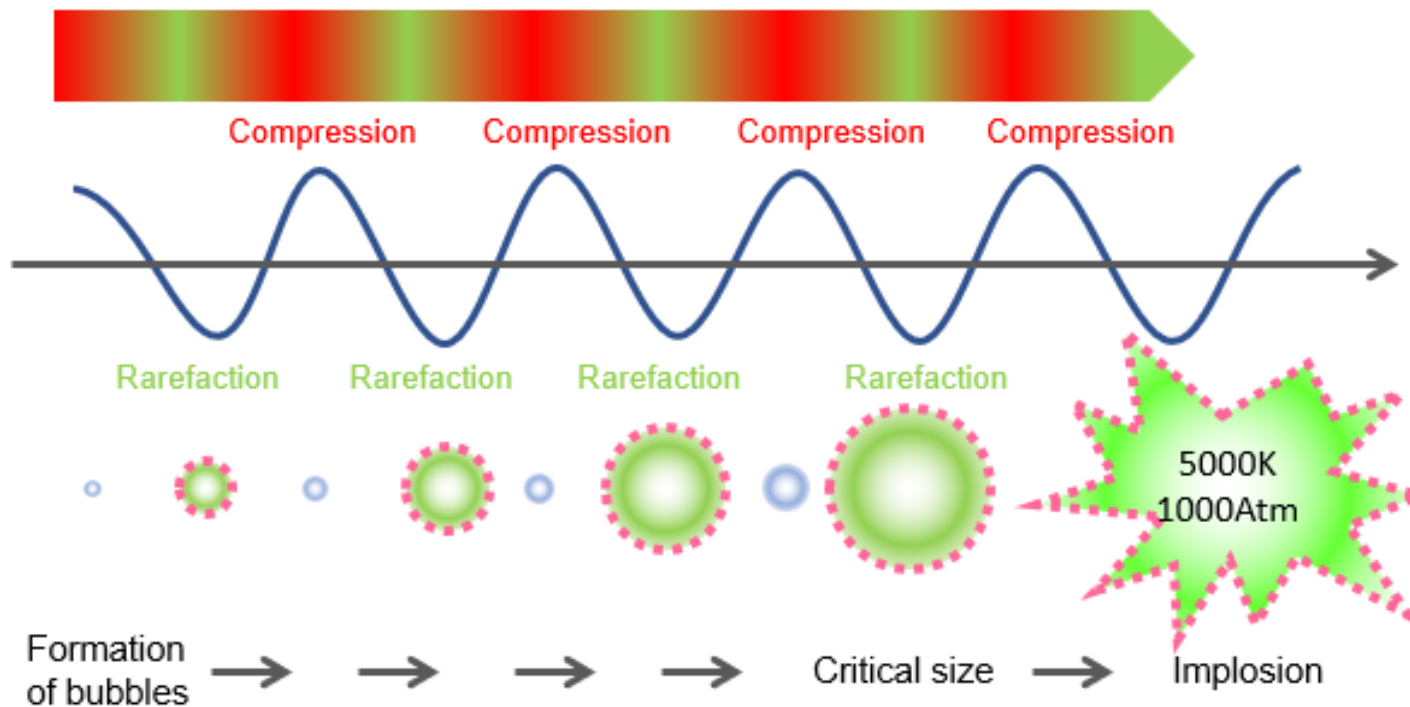
<sup>1</sup> revised IFM, Chemistry and Food Technology Department, ETSIAB, Universidad Politécnica de Madrid, Avenida Puerta de Hierro 2, 28040 Madrid, Spain

<https://doi.org/10.3390/foods10071472>





# Ultrasounds



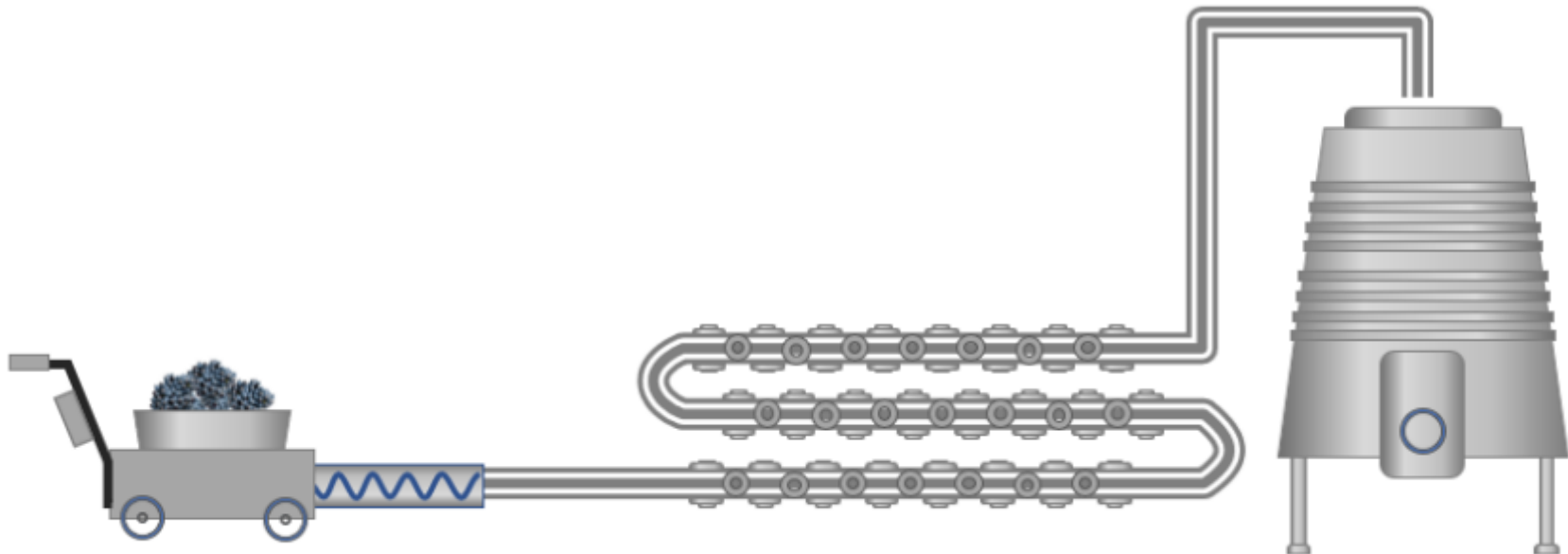


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# Ultrasounds



# Conclusions

- Non-thermal technologies
- Accelerated phenol extraction
- Gentle with pigments and aromatic molecules
- Antimicrobial effectivity
- PPO control
- SO<sub>2</sub> reduction
  
- Facilitate new biotechnologies
  - Use of non-*Saccharomyces*
  - Coinoculation (Yeast-Bacteria)

## Emerging Technologies to Increase Extraction, Control Microorganisms, and Reduce SO<sub>2</sub>

<https://www.intechopen.com/chapters/71684>

## Use of UHPH to Obtain Juices With Better Nutritional Quality and Healthier Wines With Low Levels of SO<sub>2</sub>

<https://www.frontiersin.org/articles/10.3389/fnut.2020.598286/full>



### White Wine Technology

1st Edition

☆☆☆☆☆ Write a review

Editor: Antonio Morata

Paperback ISBN: 9780128234976

Imprint: Academic Press

Published Date: 6th September 2021

# Muchas gracias!

**Antonio Morata**

Universidad Politécnica de Madrid

Spain

[antonio.morata@upm.es](mailto:antonio.morata@upm.es)

<https://blogs.upm.es/wineprof/antonio-morata/>

<https://www.researchgate.net/profile/Antonio-Morata>

<https://www.linkedin.com/in/antonio-morata-barrado-00b07a82/>