OENOBIO
Project n°: 2018-1-FR01-KA203-047839
Funded by the Erasmus+ Programme of the European Union

Cleaning and disinfection in organic wine production

Joan M. Canals

UNIVERSITAT ROVIRA i VIRGILI
Facultat d'Enologia

OENOBIO
Project n°: 2018-1-FR01-KA203-047839
Funded by the Erasmus+ Programme of the European Union
FACULTAT D'ENOLOGIA
Universitat Rovira i Virgili

Principles of cleaning and disinfection

1. Prewash: Removing dirtiness from the surfaces of installations
2. Cleaning: Removal of dirtiness adhering to the surfaces of installations.
3. First rinse: Remove detergent residues.
4. Disinfection: Removal of residual microorganisms.
5. Second rinse: Removal of residual disinfectants.

OENOBIO
Project n°: 2018-1-FR01-KA203-047839
Funded by the Erasmus+ Programme of the European Union
FACULTAT D'ENOLOGIA
Universitat Rovira i Virgili

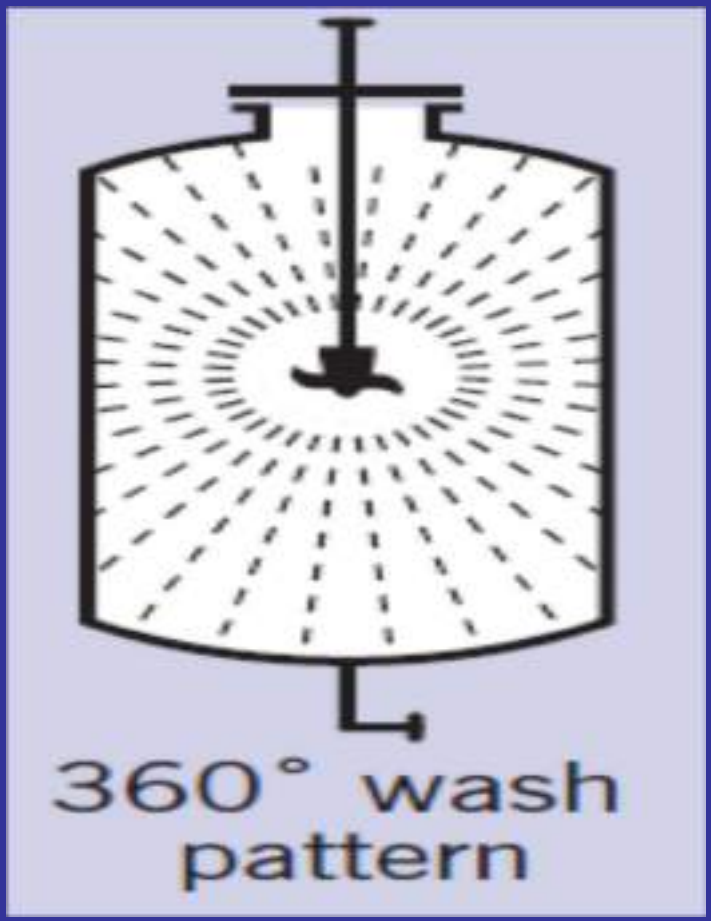
Importance of hygiene in wine containers

- **Control and dominate the hygiene of wine containers allows:**
  - Eliminate the risk of chemical contamination;
  - Reduce the risk of microbiological contamination;
  - Maintain the favorable changes to the stabilization or improvement of the quality of the wines along the aging process and in particular in the case of aging in wood.

OENOBIO
Project n°: 2018-1-FR01-KA203-047839
Funded by the Erasmus+ Programme of the European Union
FACULTAT D'ENOLOGIA
Universitat Rovira i Virgili

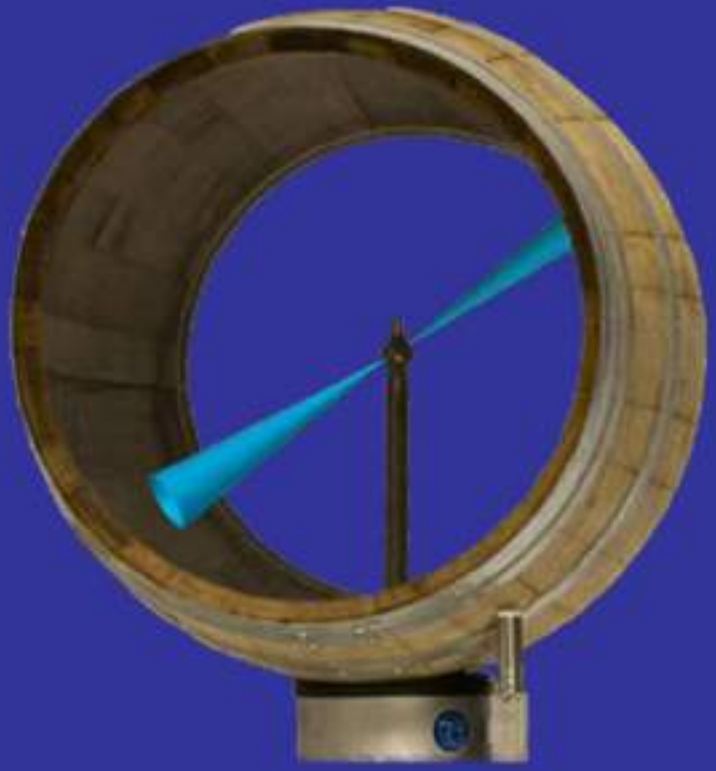
Operations can be done manually

OENOBIO
Project n°: 2018-1-FR01-KA203-047839
Funded by the Erasmus+ Programme of the European Union
FACULTAT D'ENOLOGIA
Universitat Rovira i Virgili



OENOBIO
Project n°: 2018-1-FR01-KA203-047839
Funded by the Erasmus+ Programme of the European Union
FACULTAT D'ENOLOGIA
Universitat Rovira i Virgili

or by automatic means in barrels



OENOBIO
Project n°: 2018-1-FR01-KA203-047839
Funded by the Erasmus+ Programme of the European Union
FACULTAT D'ENOLOGIA
Universitat Rovira i Virgili

The only products that can be used in organic wine production are the following:

- Sodium Hydroxide,
- Soft soap
- Peracetic Acid
- Hydrogen peroxide
- Citric Acid
- Quaternary ammonium
- Potassium metabilsulphite
- Solutions of ethanol in water

OENOBIO
Project n°: 2018-1-FR01-KA203-047839
Funded by the Erasmus+ Programme of the European Union
FACULTAT D'ENOLOGIA
Universitat Rovira i Virgili

These products are quite effective in most of the materials of wineries such as stainless steel, plastic and metalic pipes, pumps, pressing and bottling machines, etc…

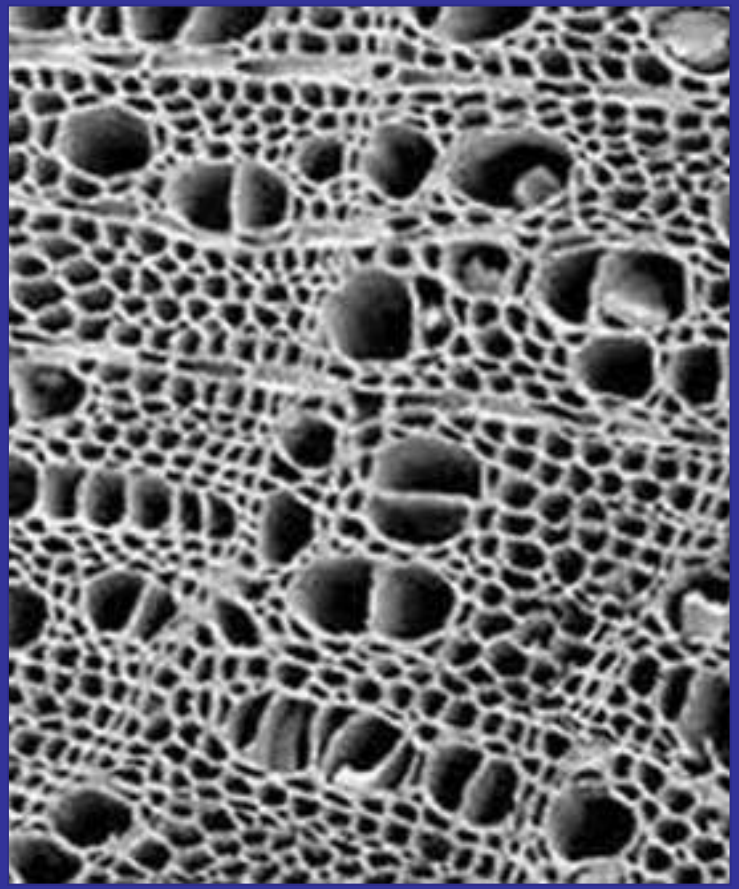
But most of them cannot employed in oak barrels because it can degrade the wood itself or can impregnate the porous wood material and therefore contaminate the wine

OENOBIO
Project n°: 2018-1-FR01-KA203-047839
Funded by the Erasmus+ Programme of the European Union

FACULTAT D'ENOLOGIA
Universitat Rovira i Virgili

The different surfaces

stainless steel



Wood

OENOBIO
Project n°: 2018-1-FR01-KA203-047839
Funded by the Erasmus+ Programme of the European Union

FACULTAT D'ENOLOGIA
Universitat Rovira i Virgili

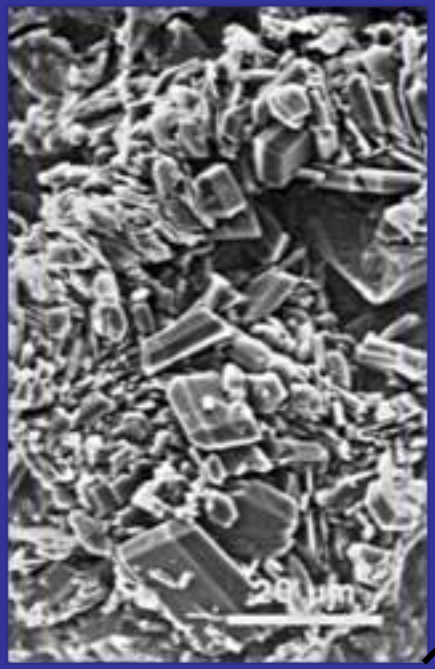
The traditional practice of burning sulfur inside the barrels

This practice will be forbidden

OENOBIO
Project n°: 2018-1-FR01-KA203-047839
Funded by the Erasmus+ Programme of the European Union

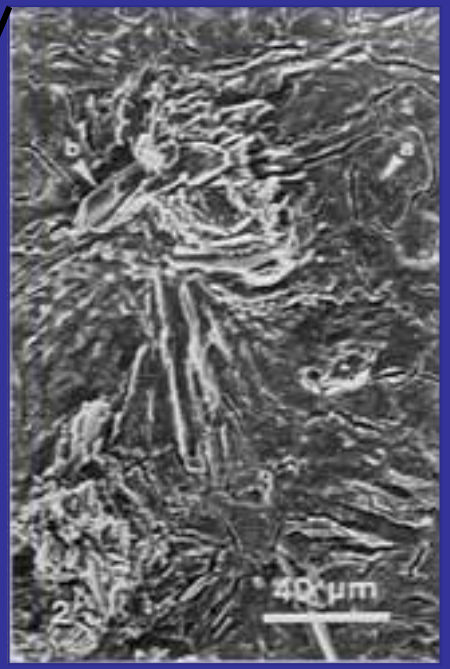
FACULTAT D'ENOLOGIA
Universitat Rovira i Virgili

Maintenance of wood barrels with red wine



Crystals

Cleaning Rinsing

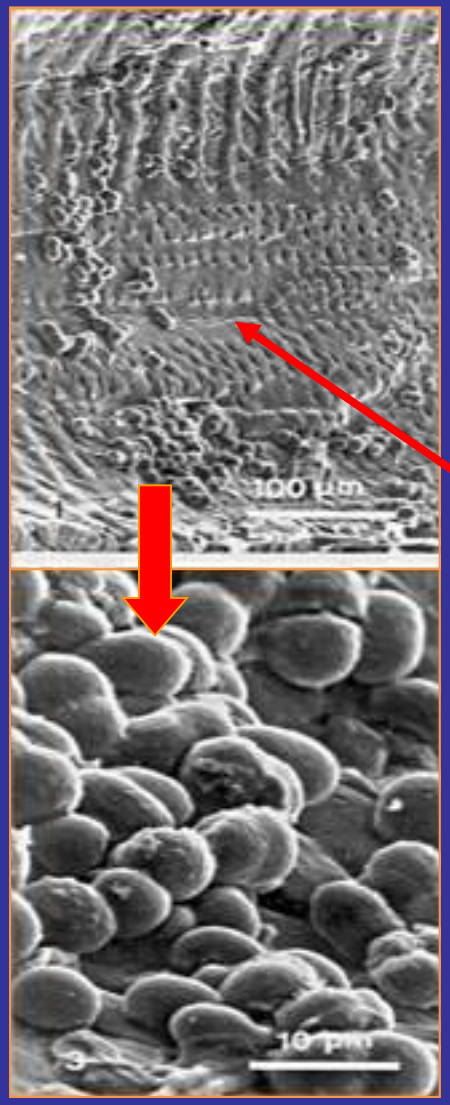


coloring matter

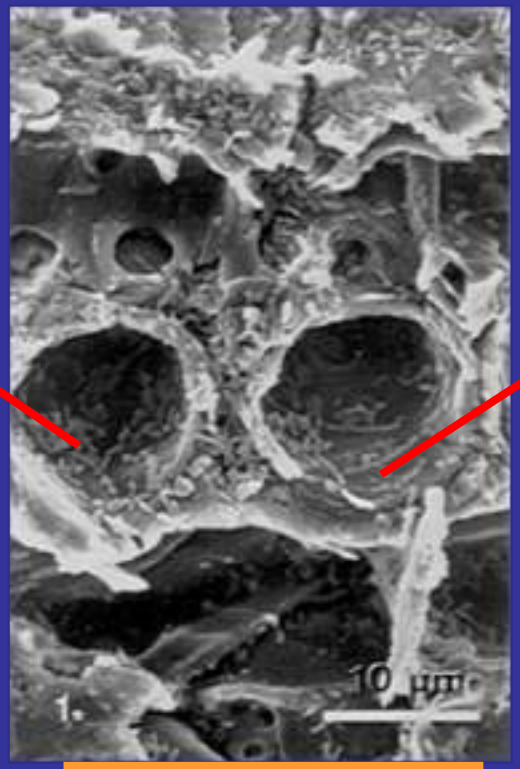
OENOBIO
Project n°: 2018-1-FR01-KA203-047839
Funded by the Erasmus+ Programme of the European Union

FACULTAT D'ENOLOGIA
Universitat Rovira i Virgili

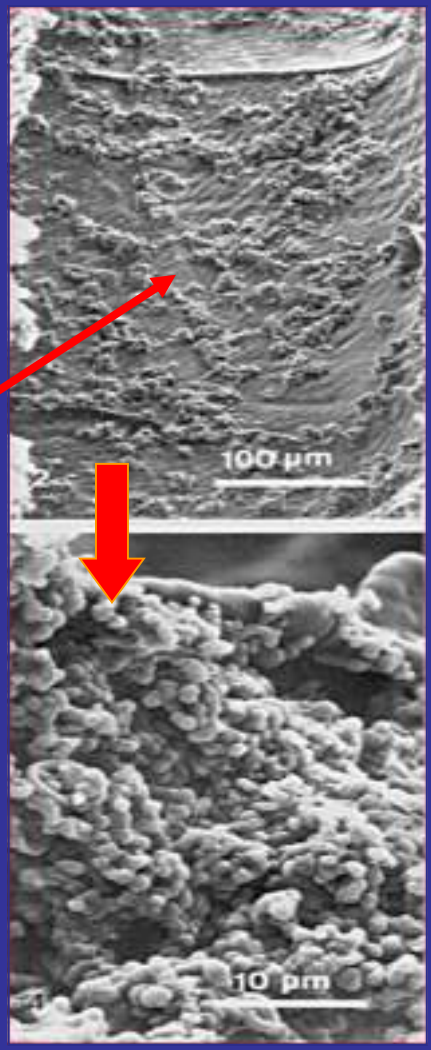
The microporosity of wood; an ideal refuge



Yeasts : *Brettanomyces sp.*



Surface of a stave after rinsing



Bacterias : *Acetobacter aceti*

OENOBIO
Project n°: 2018-1-FR01-KA203-047839
Funded by the Erasmus+ Programme of the European Union
FACULTAT D'ENOLOGIA
Universitat Rovira i Virgili

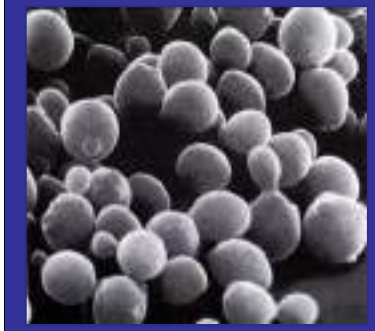
Disinfection:

Destruction of viable germs to reduce in depth the residual populations by chemical and/or physical action

OENOBIO
Project n°: 2018-1-FR01-KA203-047839
Funded by the Erasmus+ Programme of the European Union
FACULTAT D'ENOLOGIA
Universitat Rovira i Virgili

Main dangerous microorganisms to wine quality

- **Yeasts**
  - Aerobic: forming films
    - *Hansenula*
    - *Pichia…*
  - Anaerobic:
    - *Saccharomyces*
    - *Zigosaccharomyces*
    - *Brettanomyces*
- **Bacteria**
  - Aerobic:
    - *Acetobacteria*
  - Anaerobic: Lactic bacteria:
    - *Leuconostoc*
    - *Pediococcus*
    - *Lactobacilus*



OENOBIO
Project n°: 2018-1-FR01-KA203-047839
Funded by the Erasmus+ Programme of the European Union
FACULTAT D'ENOLOGIA
Universitat Rovira i Virgili

Different approaches for disinfection of wooden containers

- **Disinfection by chemical means**:
  - Acidifying agents = sulfur dioxide
  - Oxidizing agents:
    - Halogen agents = **unusable in the cellar!**
    - Peroxides
    - Permanganate
    - Ozone
- **Disinfection by physical means:**
  - Thermally:
    - Hot water
    - Water Vapor
    - Electromagnetic treatment = microwaves
  - Ultrasounds
  - Dry ice

OENOBIO
Project n°: 2018-1-FR01-KA203-047839
Funded by the Erasmus+ Programme of the European Union
FACULTAT D'ENOLOGIA
Universitat Rovira i Virgili

1-. Employment of sulfur dioxide:

OENOBIO
Project n°: 2018-1-FR01-KA203-047839
Funded by the Erasmus+ Programme of the European Union
FACULTAT D'ENOLOGIA
Universitat Rovira i Virgili

Employment of sulfur dioxide

- **In liquid form (in the wine):**
  - Potassium metabisulfite solution
- **In gaseous form (over wood and wine):**
  - Combustion of sulfur, tablets or wicks (x2).
  - Using liquefied gas.

OENOBIO
Project n°: 2018-1-FR01-KA203-047839
Funded by the Erasmus+ Programme of the European Union
FACULTAT D'ENOLOGIA
Universitat Rovira i Virgili

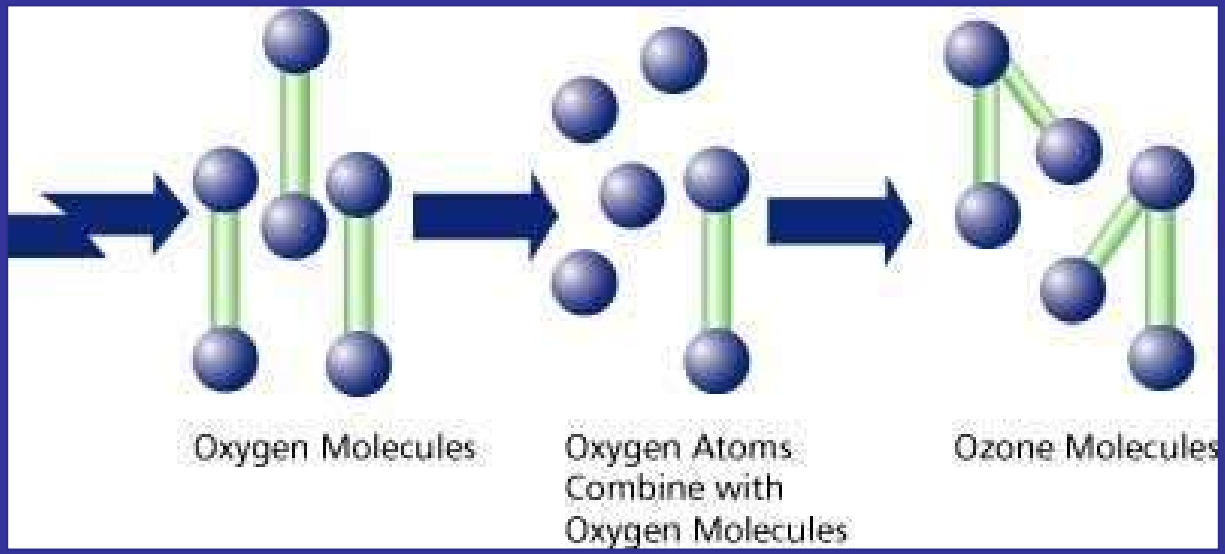
1. SO_2: Add directly to wine? or treat the wood?

Conditions of adding sulfites	Measured parameter	t =0	t = 3 months	t = 4,5 months
Tablet 7.5 g of sulfur per barrel	Free SO2 (mg/l) *Brettanomyces*/ml Ethyl-phenol (µg/l)	22 6 285	16 0 285	13 1 293
Tablet 5.0 g of sulfur per barrel	Free SO2 (mg/l) *Brettanomyces*/ml Ethyl-phenol (µg/l)	14 6 285	11 0 285	8 0 288
Sulfur solution added directly to the wine 2g/Hl	Free SO2 (mg/l) *Brettanomyces*/ml Ethyl-phenol (µg/l)	13 6 285	10 510 296	6 1200 652

The efficiency is higher when the SO2 is applied to clean wood!

OENOBIO
Project n°: 2018-1-FR01-KA203-047839
Funded by the Erasmus+ Programme of the European Union
FACULTAT D'ENOLOGIA
Universitat Rovira i Virgili

2-. Ozonated water



OENOBIO
Project n°: 2018-1-FR01-KA203-047839
Funded by the Erasmus+ Programme of the European Union
FACULTAT D'ENOLOGIA
Universitat Rovira i Virgili

Use of ozonated water

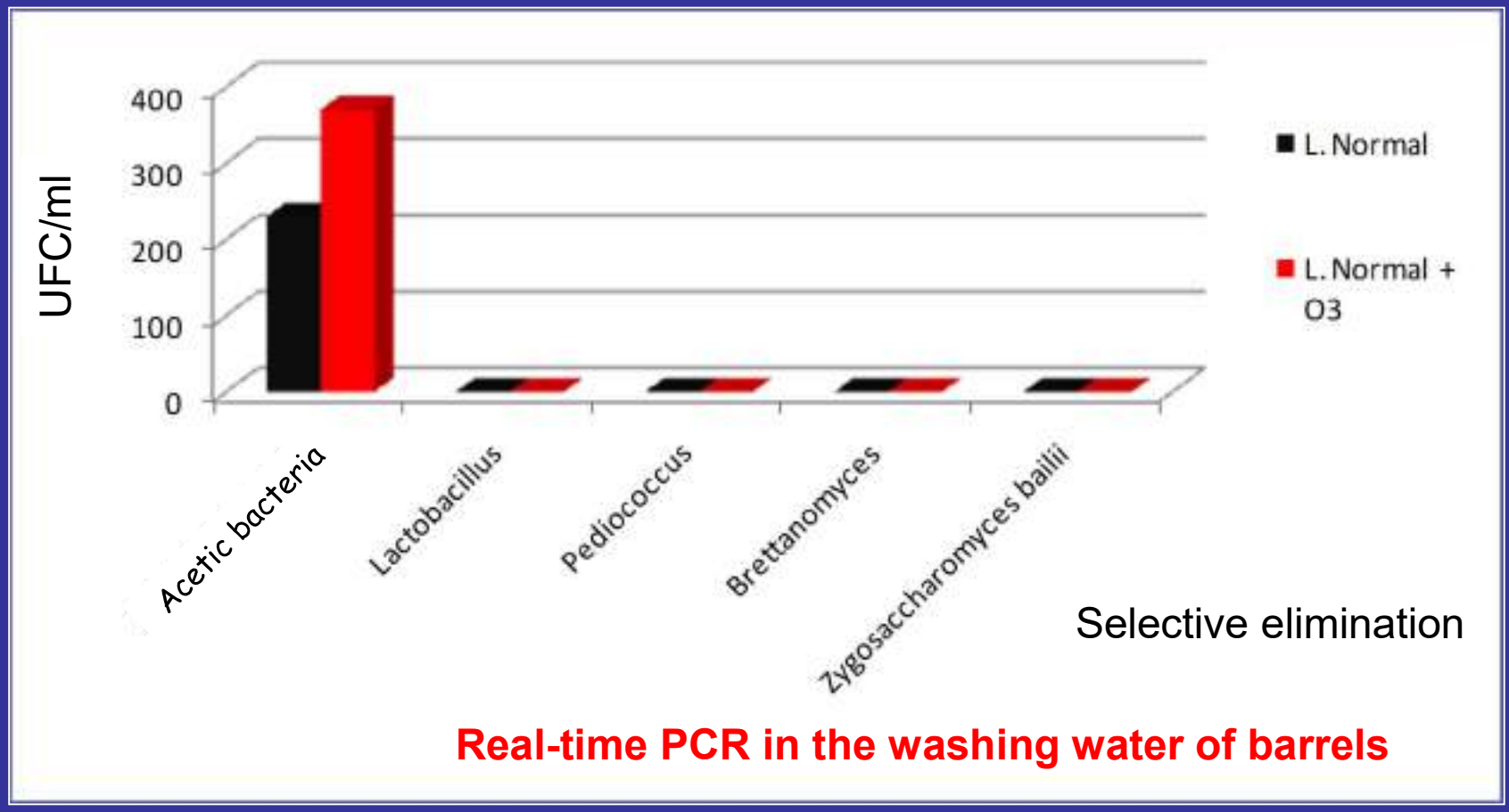
Barrels treated with a generation of 15 g ozone/h, 1.5 ppm in water barrels (it is not enough).

Concentration	*Normal cleaning*	*Normal cleaning* + O_3
Ethyle Ac. (mg/L)	0,5	0,1
4-EF (µg/L)	33,7	11
4-EG (µg/L)	4,3	0,4
TCA (ng/L)	nd	nd
TeCA (ng/L)	nd	nd
TBA (ng/L)	nd	nd
PCA (ng/L)	nd	nd

OENOBIO
Project n°: 2018-1-FR01-KA203-047839
Funded by the Erasmus+ Programme of the European Union

FACULTAT D'ENOLOGIA
Universitat Rovira i Virgili

Use of ozonated water

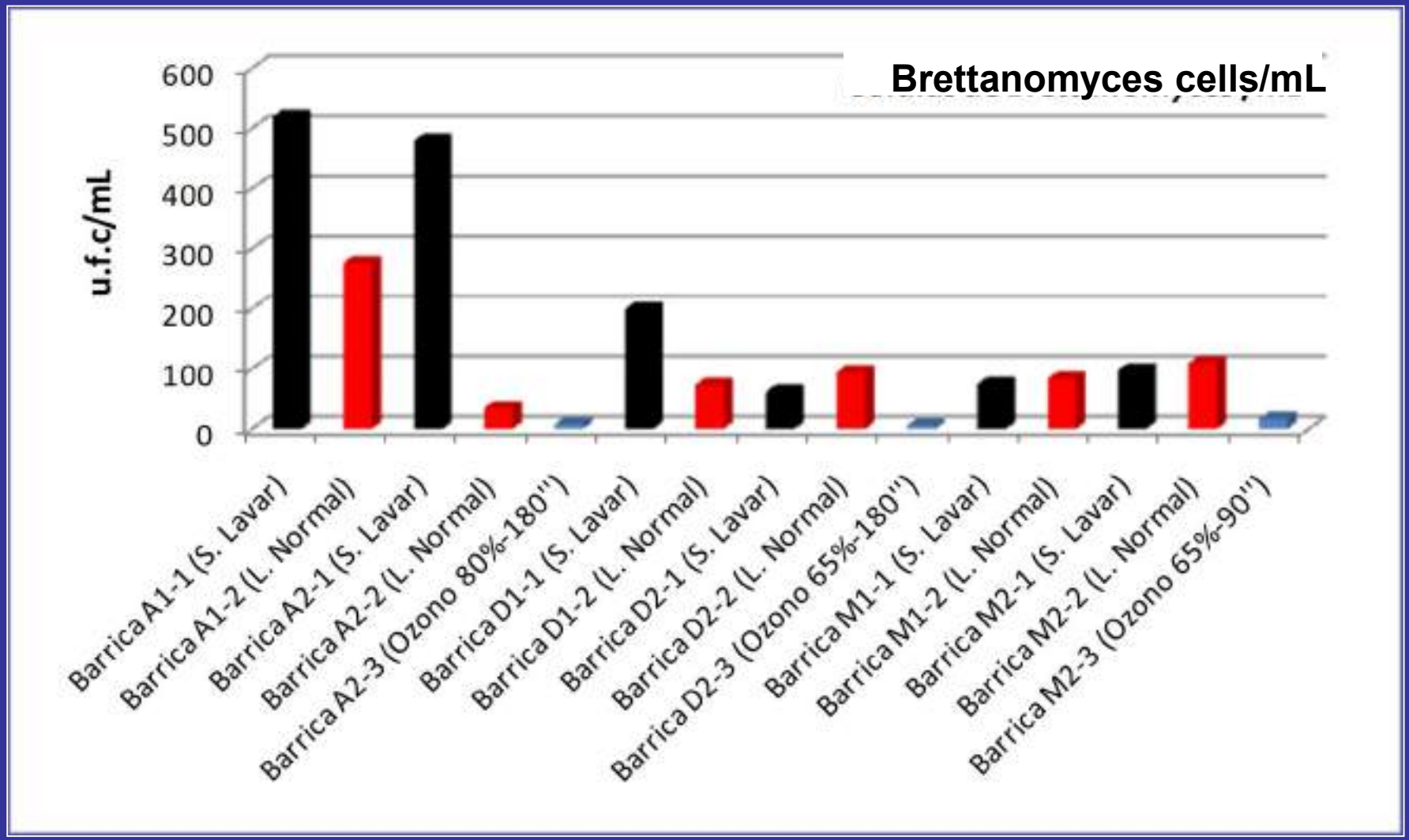


Selective elimination

Real-time PCR in the washing water of barrels

OENOBIO
Project n°: 2018-1-FR01-KA203-047839
Funded by the Erasmus+ Programme of the European Union
FACULTAT D'ENOLOGIA
Universitat Rovira i Virgili

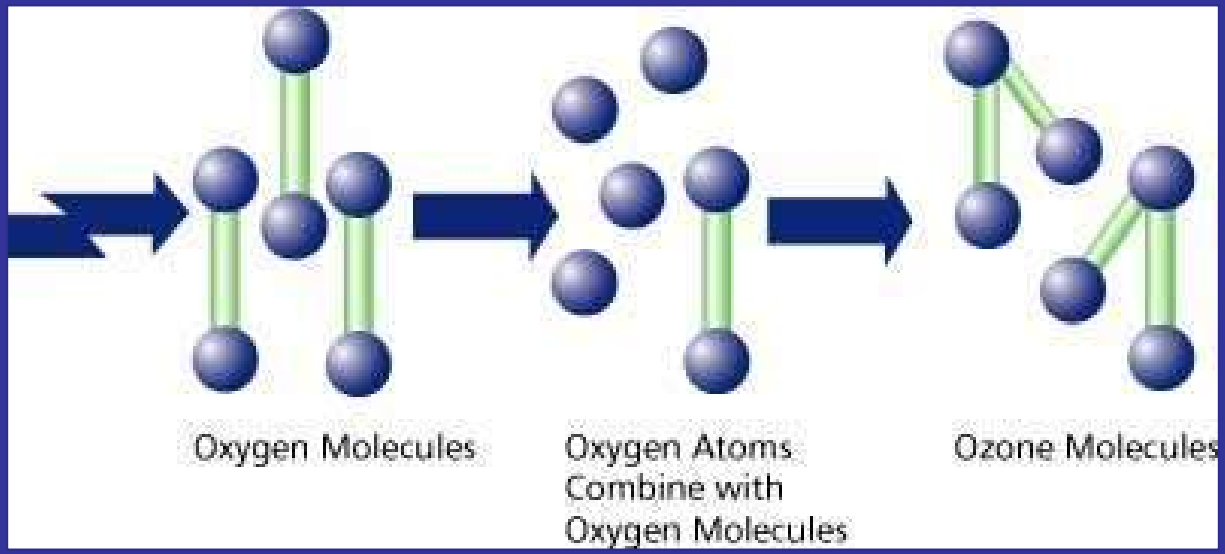
Use of ozonated water



Specific culture media in washing water of the barrels

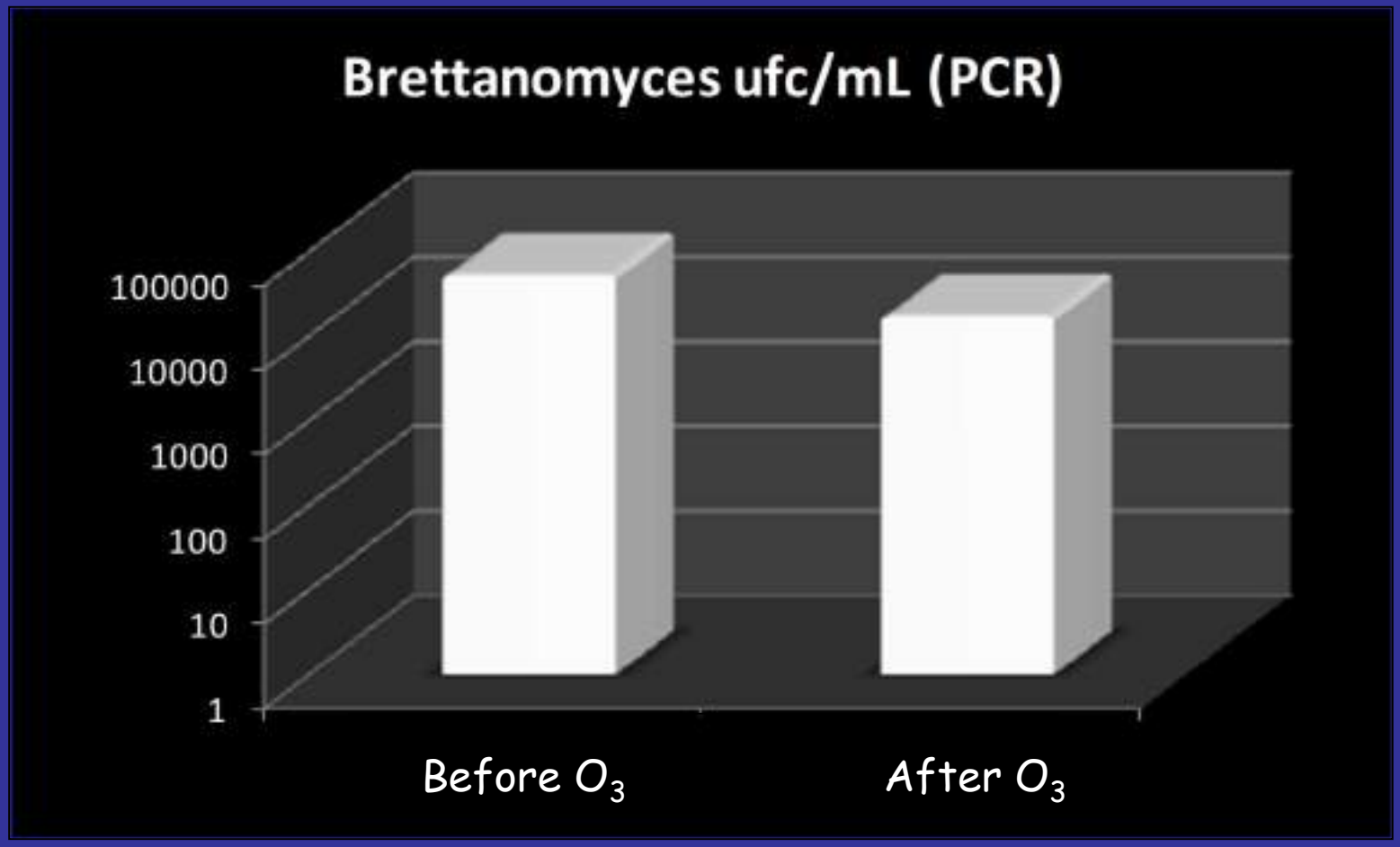
OENOBIO
Project n°: 2018-1-FR01-KA203-047839
Funded by the Erasmus+ Programme of the European Union
FACULTAT D'ENOLOGIA
Universitat Rovira i Virgili

3-. Ozonated gas



OENOBIO
Project n°: 2018-1-FR01-KA203-047839
Funded by the Erasmus+ Programme of the European Union
FACULTAT D'ENOLOGIA
Universitat Rovira i Virgili

Use of ozonated gas (O_3)



Application of Ozone gas: 30 ppm; 10 min., Without pressure, by exposure. Tempranillo 2011

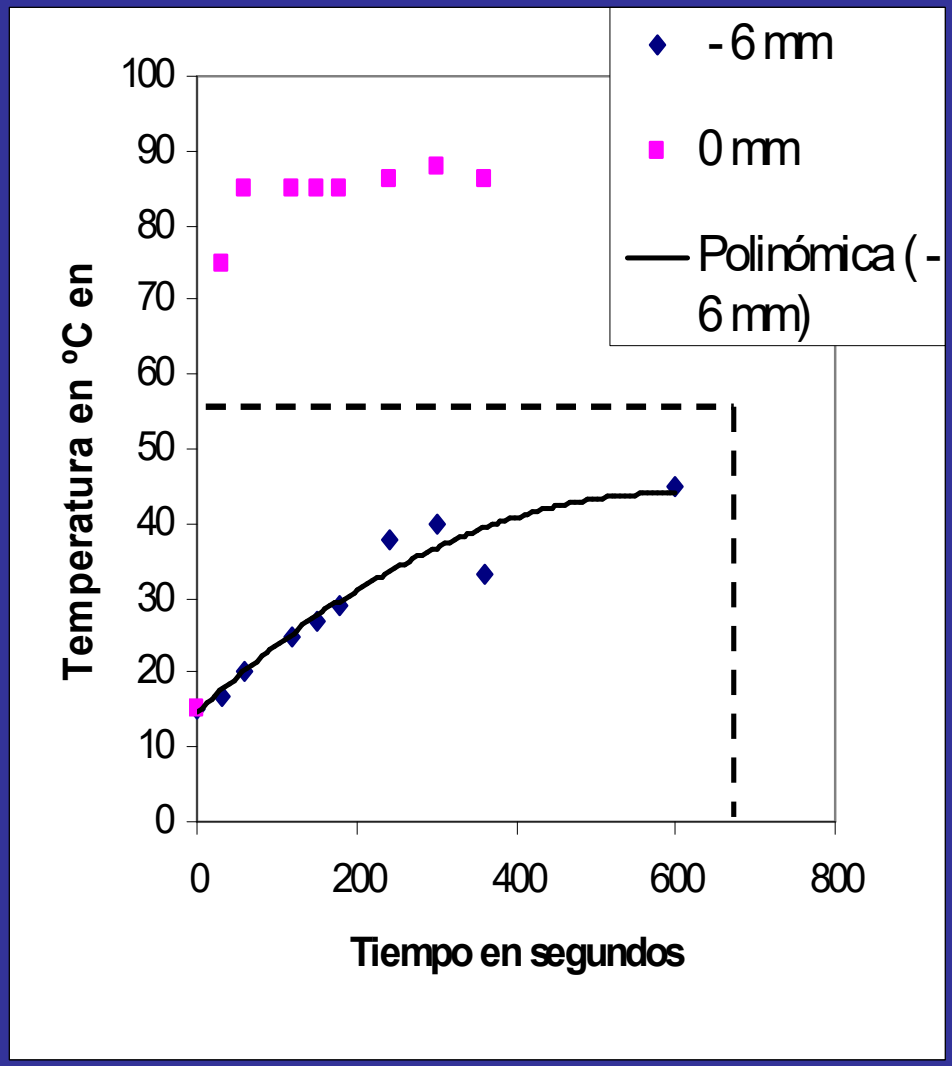
OENOBIO
Project n°: 2018-1-FR01-KA203-047839
Funded by the Erasmus+ Programme of the European Union
FACULTAT D'ENOLOGIA
Universitat Rovira i Virgili

4-. Thermal treatments :

OENOBIO
Project n°: 2018-1-FR01-KA203-047839
Funded by the Erasmus+ Programme of the European Union

FACULTAT D'ENOLOGIA
Universitat Rovira i Virgili

Use of hot water



Hot water pressure washers with mobile compressor may produce water at 80-90 ° C between 80 and 300 bars

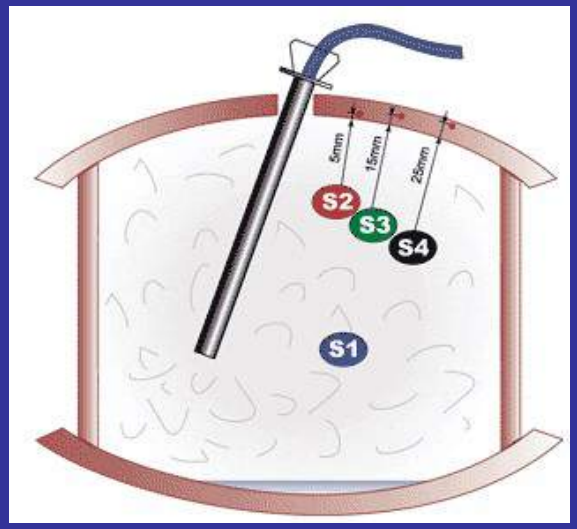
This device allows you to clean without detergent and disinfect the surface; disinfecting efficacy is limited in depth because the temperature rise is too slow!

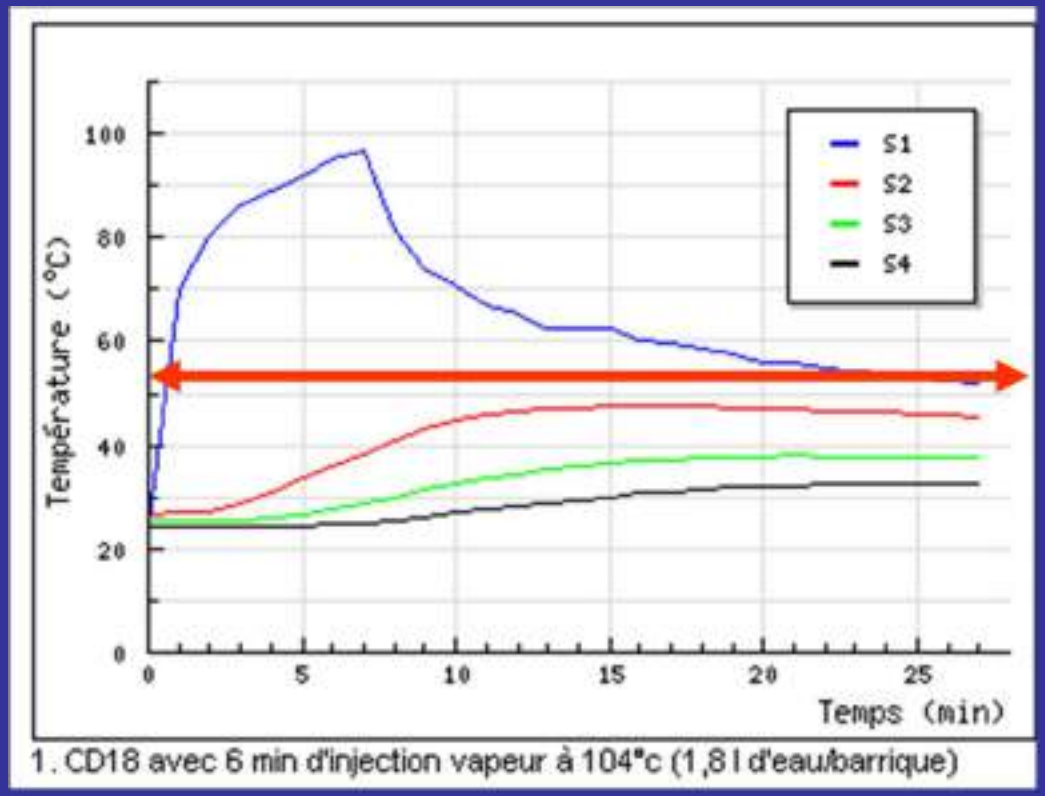
→ Wood staves swells which improve tightness

OENOBIO
Project n°: 2018-1-FR01-KA203-047839
Funded by the Erasmus+ Programme of the European Union
FACULTAT D'ENOLOGIA
Universitat Rovira i Virgili

Vapor heat treatment at 105 ° C

* Generator output, input to the barrel takes 3 minutes to reach this temperature, hold for 3 more minutes. Attention not more than 10 min. (blisters).





1. CD18 avec 6 min d'injection vapeur à 104°c (1,8 l d'eau/barrique)

S1 : air temperature in the barrel
S2 : temperature 5mm. within wood
S3 : temperature 15 mm.
S4 : temperature 25 mm.

Datos C. DURET ™ - VAPOCLEAN ®

OENOBIO
Project n°: 2018-1-FR01-KA203-047839
Funded by the Erasmus+ Programme of the European Union

FACULTAT D'ENOLOGIA
Universitat Rovira i Virgili

Vapor heat treatment at 105 ° C

Normal wash: hot water at 80 ° C for 3 minutes
Vapor Treatment: Normal Wash + high pressure vapor: 95 ° C for 3 min at 10 bar.

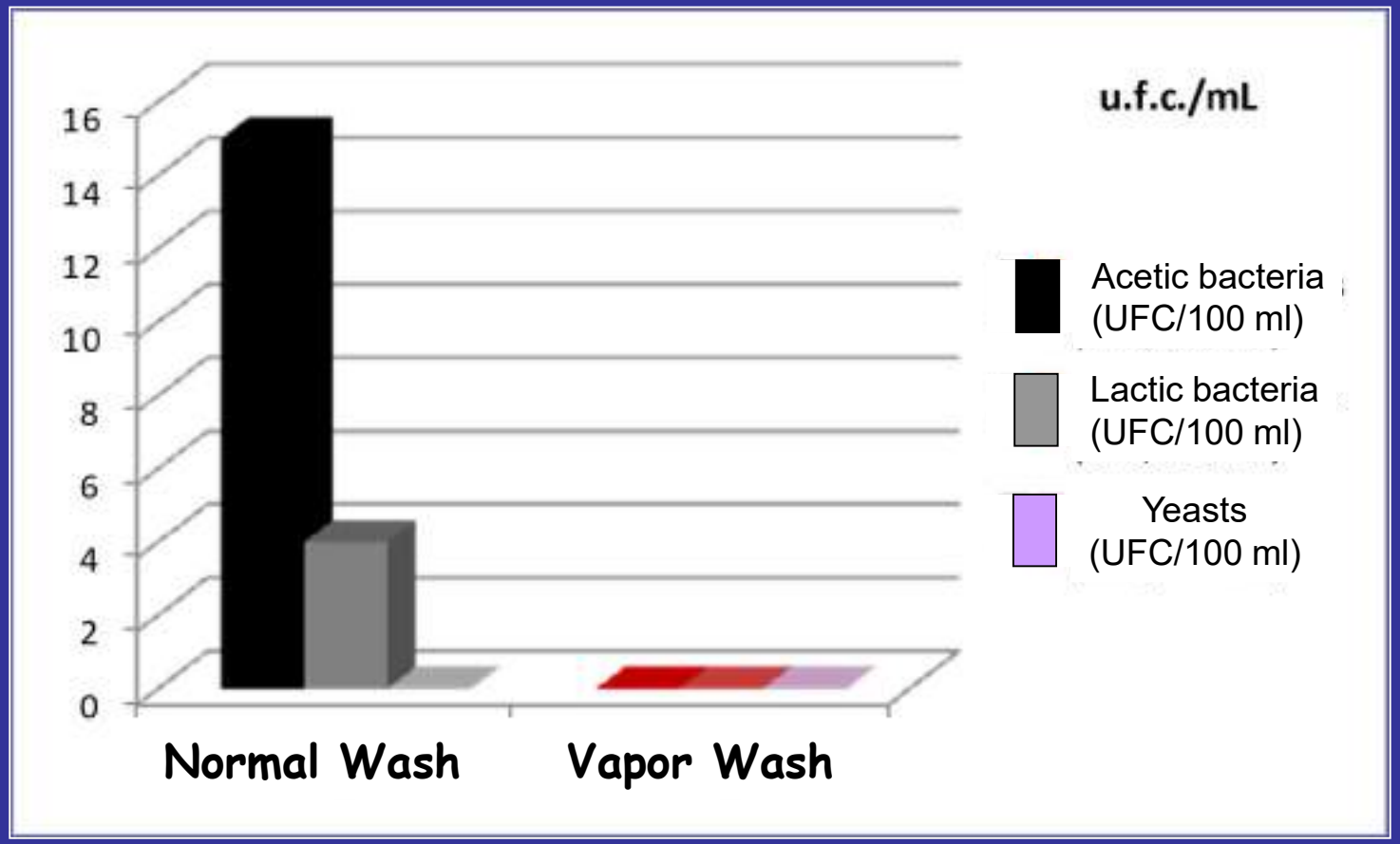
Concentration	Normal Wash	Vapor Wash
Ac. Etilo (mg/L)	0,9	0,8
4-EF (µg/L)	19,4	6,3
4-EG (µg/L)	1,7	0,5
TCA (ng/L)	nd	nd
TeCA (ng/L)	nd	nd
TBA (ng/L)	nd	nd
PCA (ng/L)	nd	nd

Gas Chromatography and Mass Spectrometry (CGSM) in washing water barrels

OENOBIO
Project n°: 2018-1-FR01-KA203-047839
Funded by the Erasmus+ Programme of the European Union

FACULTAT D'ENOLOGIA
Universitat Rovira i Virgili

Vapor heat treatment at 105 ° C



OENOBIO
Project n°: 2018-1-FR01-KA203-047839
Funded by the Erasmus+ Programme of the European Union
FACULTAT D'ENOLOGIA
Universitat Rovira i Virgili

5- Ultrasounds:

OENOBIO
Project n°: 2018-1-FR01-KA203-047839
Funded by the Erasmus+ Programme of the European Union

FACULTAT D'ENOLOGIA
Universitat Rovira i Virgili

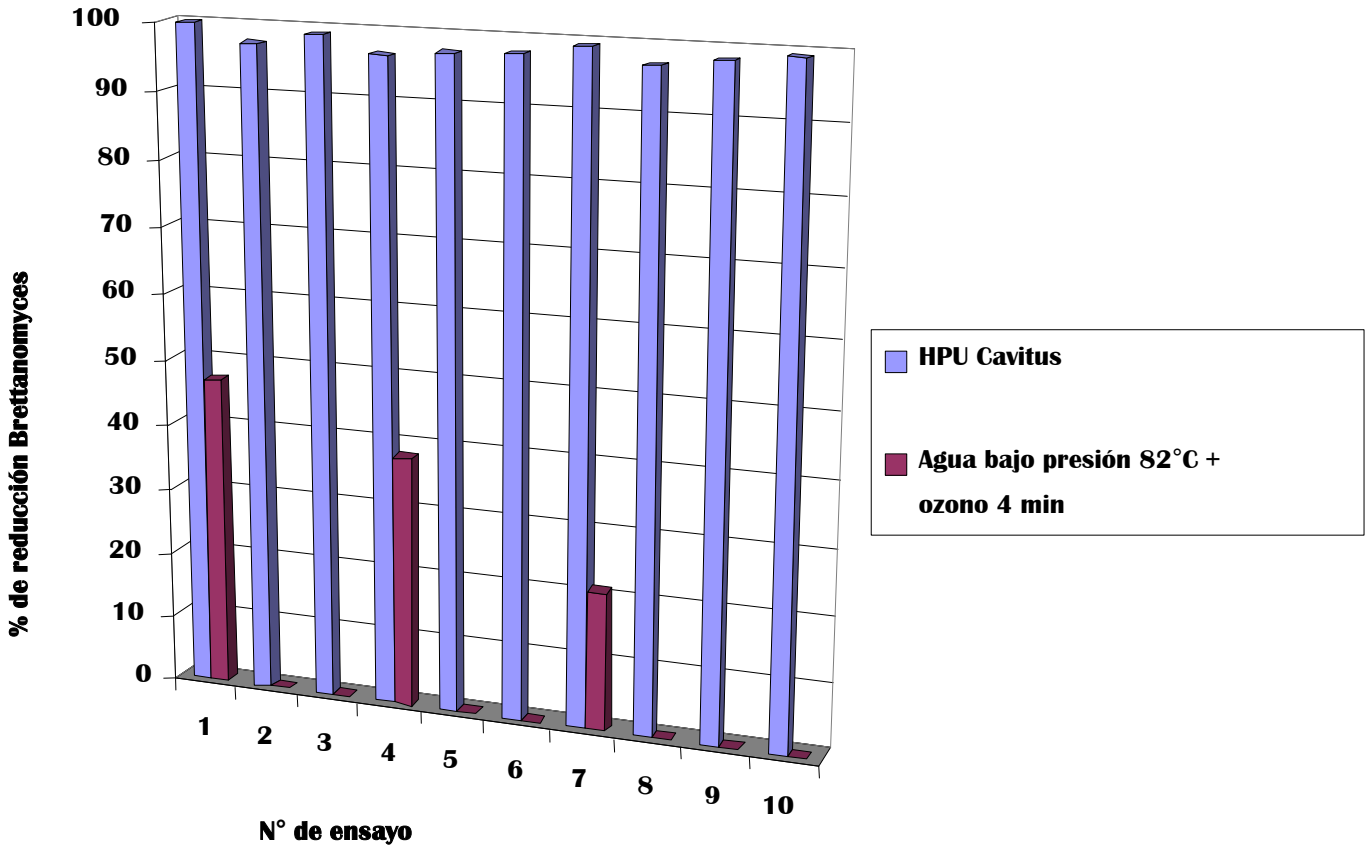
Treatment by ultrosounds (Cavitus®)

- One Sonotron is inserted into the barrel filled with recycled water (60 ° C)
- The ultrasound (150 kHz) produced on the first millimeters of the surface of the wood high pressure to the microscopic level millimeters (> 2000 bars) by cavitation of water, cleaning completely and destroying micro-organisms at the same time (disinfection).

OENOBIO
Project n°: 2018-1-FR01-KA203-047839
Funded by the Erasmus+ Programme of the European Union

FACULTAT D'ENOLOGIA
Universitat Rovira i Virgili

Treatment by ultrosounds (Cavitus®)



OENOBIO
Project n°: 2018-1-FR01-KA203-047839
Funded by the Erasmus+ Programme of the European Union

FACULTAT D'ENOLOGIA
Universitat Rovira i Virgili

Treatment by ultrosounds

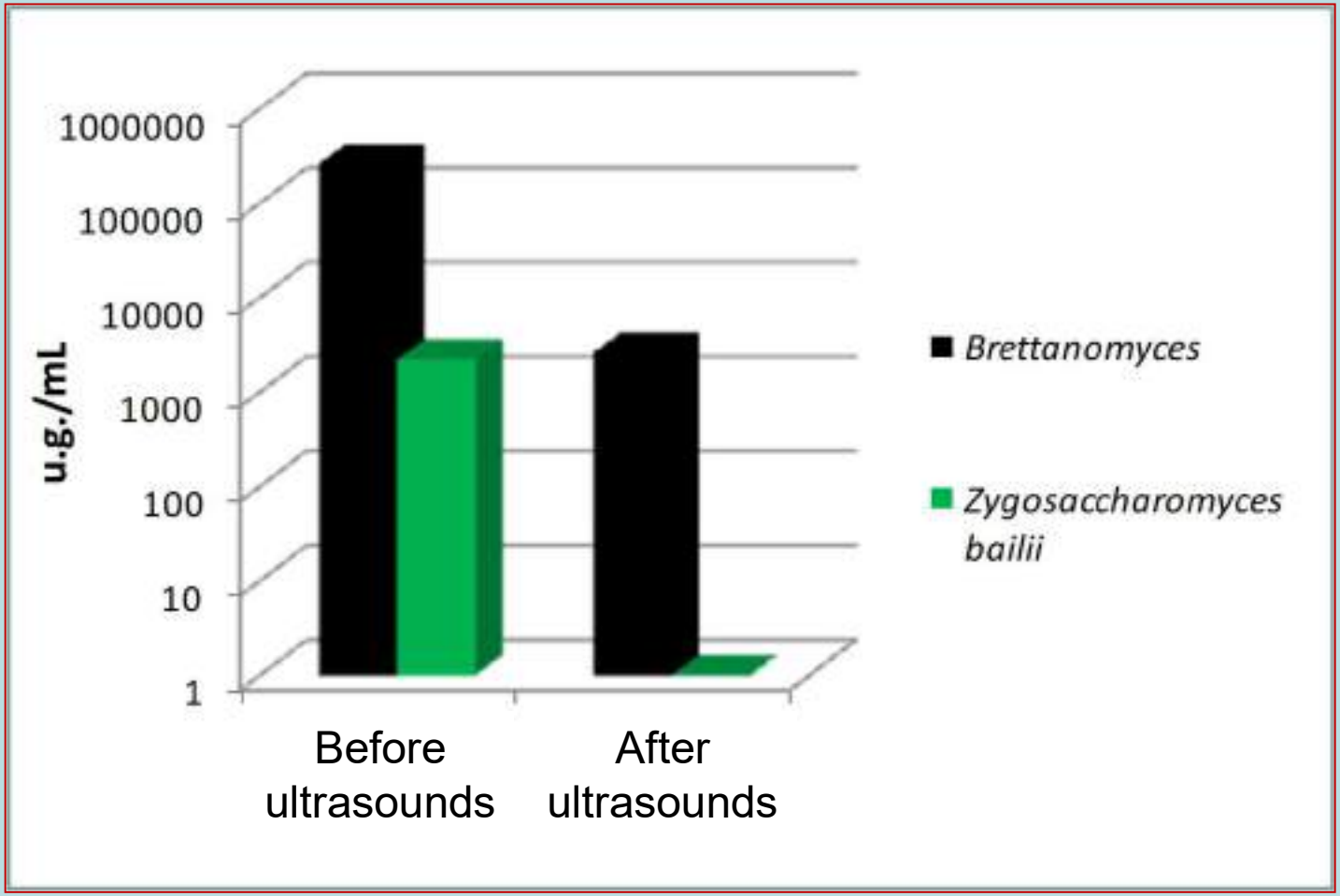
Real-time PCR in washing water

u.g./gramo	Bacterias Acéticas	*Lactobacillus*	*Pediococcus*	*Brettanomyces*	*Zygosaccharomyces bailii*
Lote C36	82	10	0	330	0
Lote C36 (3 min y 65°C)	44	120	0	0	0
Lote C72	830	650	0	0	0
Lote C72 (3 min y 65°C)	18	26	0	0	0
Lote B36	260	7600	0	3200	0
Lote B36 (10 min y 65°C)	40	280	0	65	0
Lote B72	45	9800	0	0	0
Lote B72 (10 min y 65°C)	71	2000	0	0	0
Lote A36	420	980	0	67	0
Lote A36 (20 min y 65°C)	0	0	0	0	0
Lote A72	170	370	0	0	0
Lote A72 (20 min y 65°C)	69	92	0	0	0

OENOBIO
Project n°: 2018-1-FR01-KA203-047839
Funded by the Erasmus+ Programme of the European Union
FACULTAT D'ENOLOGIA
Universitat Rovira i Virgili

Treatment by ultrosounds (Cavitus®)

Population u.g./mL	Before	After
Brettanomyces	260000	2600
Zygosaccharomyces bailii	2200	0



OENOBIO
Project n°: 2018-1-FR01-KA203-047839
Funded by the Erasmus+ Programme of the European Union
FACULTAT D'ENOLOGIA
Universitat Rovira i Virgili

6- Sanding:

OENOBIO
Project n°: 2018-1-FR01-KA203-047839
Funded by the Erasmus+ Programme of the European Union
FACULTAT D'ENOLOGIA
Universitat Rovira i Virgili

Inner Sanding (Barena®)

- **1. Cleaning (pickling) physico-mechanical projection of a natural abrasive**: The mineral is projected with an adjustable pressure depending on the state of the barrel. Being the aim to achieve maximum conservation of the initial roasting. The etching is made on a thickness ranging between 0.2 and 0.4 millimeters.

- **2. The mineral and the residues are evacuated** by hydraulic projection using dechlorinated water

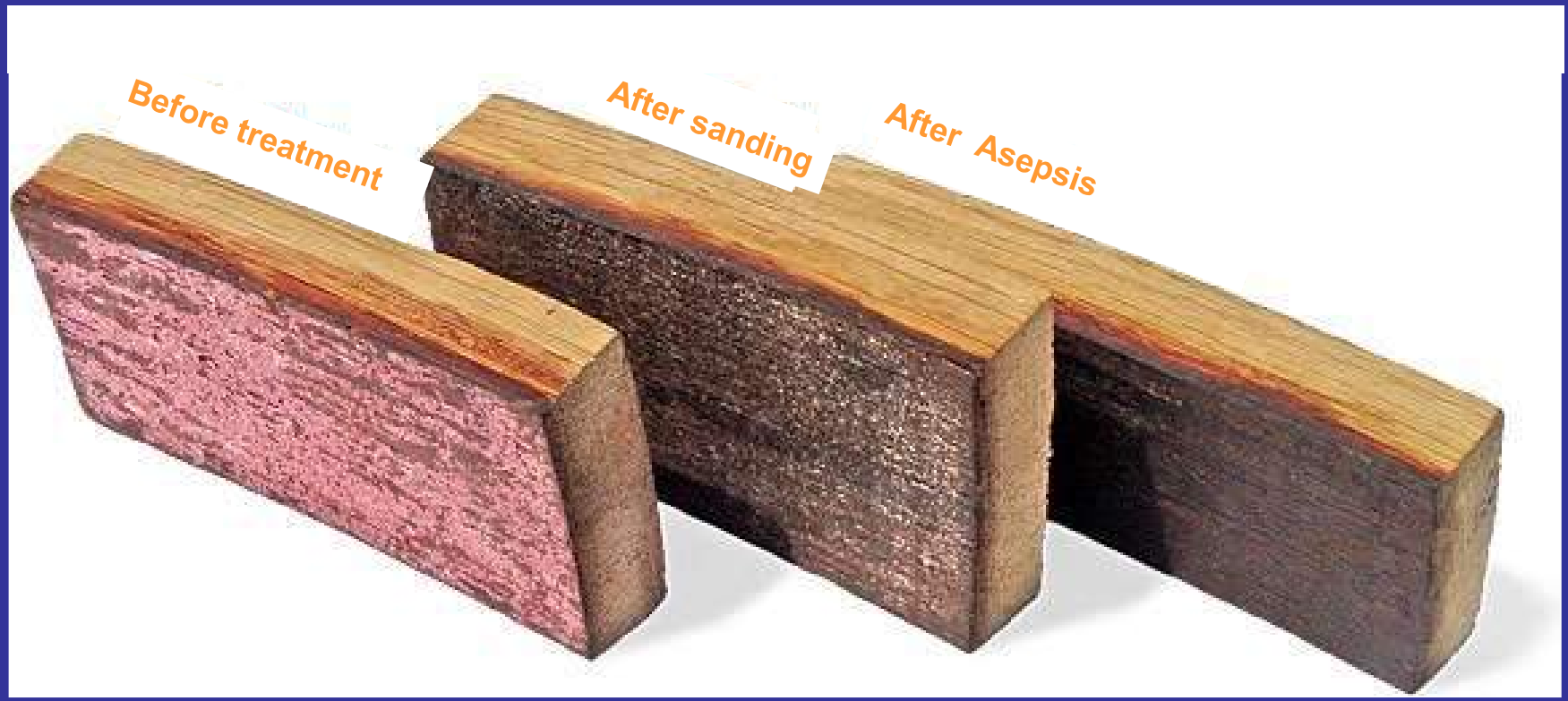
- **3. Asepsia:** To ensure the cleanliness of the barrel and full decontamination, dry vapor is applied above 100 degrees for several minutes. After this first phase of sepsis, is holding a rinse to remove colloids and coloring (anthocyanin). Subsequently gaseous sulfur is applied.

OENOBIO
Project n°: 2018-1-FR01-KA203-047839
Funded by the Erasmus+ Programme of the European Union

FACULTAT D'ENOLOGIA
Universitat Rovira i Virgili

Inner Sanding (Barena®)

The procedure allows regeneration inside the used wine barrels, through the bunghole without removing staves or funds. A natural abrasive treatment and two treatments for asepsis, vapor and sulfur dioxide are applied.



OENOBIO
Project n°: 2018-1-FR01-KA203-047839
Funded by the Erasmus+ Programme of the European Union

FACULTAT D'ENOLOGIA
Universitat Rovira i Virgili

Barrel 1 Barrel 2


AT

Sanding → Fraction 1 45º
Sanding → Fraction 2 90º


DT


OENOBIO
Project n°: 2018-1-FR01-KA203-047839
Funded by the Erasmus+ Programme of the European Union

FACULTAT D'ENOLOGIA
Universitat Rovira i Virgili

Comparison between treatments

Treatment	DRAWBACKS	ADVANTAGES
Combustion of sulfur	Limited action, formation of sulfites, long time of action, unstable (wick)	Good wine preservation. Active against acetic acid bacteria
Ozonated water	Superficial and intermediate-acting. Reactivity with organic material.	Easy Application. It is a good disinfectant. Removing anisols
Vapor	Long times. Thermal inertia of wood	Very safe. Good disinfectant. economic
Ultrasounds	Water and energy expenditure, application time, investment	Easily removes tartrates. Active at surface and intermediate level. Very innocuous with the wood