



AMORIM

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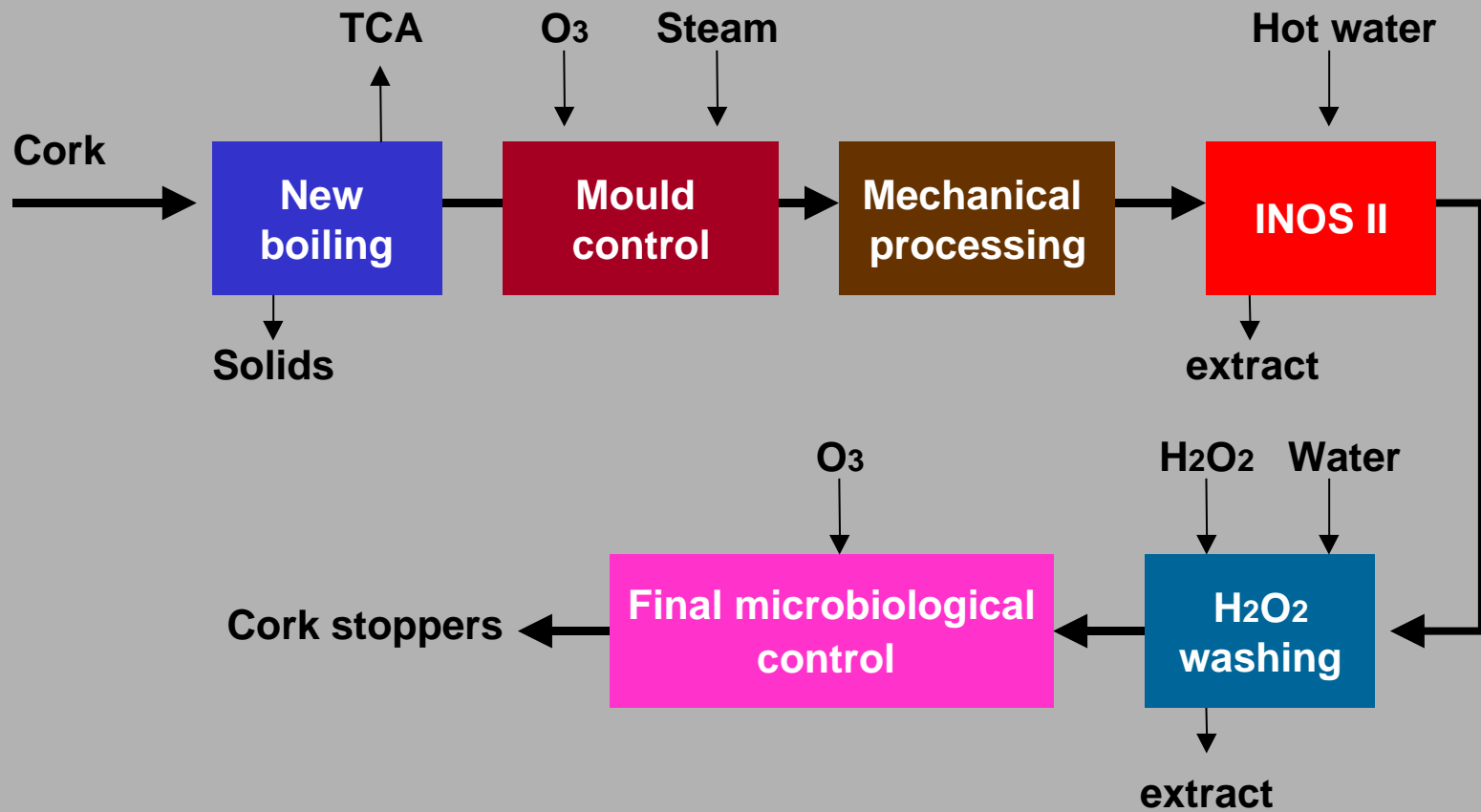
**TECHNICAL ADVANCES IN CORK  
PROCESSING**

## **What has not changed**

- **Cork remains the best closure for wine**
- **Amorim buys the best raw materials available**
- **Amorim works closely with the wine industry**
- **Amorim invests heavily in R&D**

# Advances at each stage of production

## NEW AMORIM PRODUCTION PROCESS



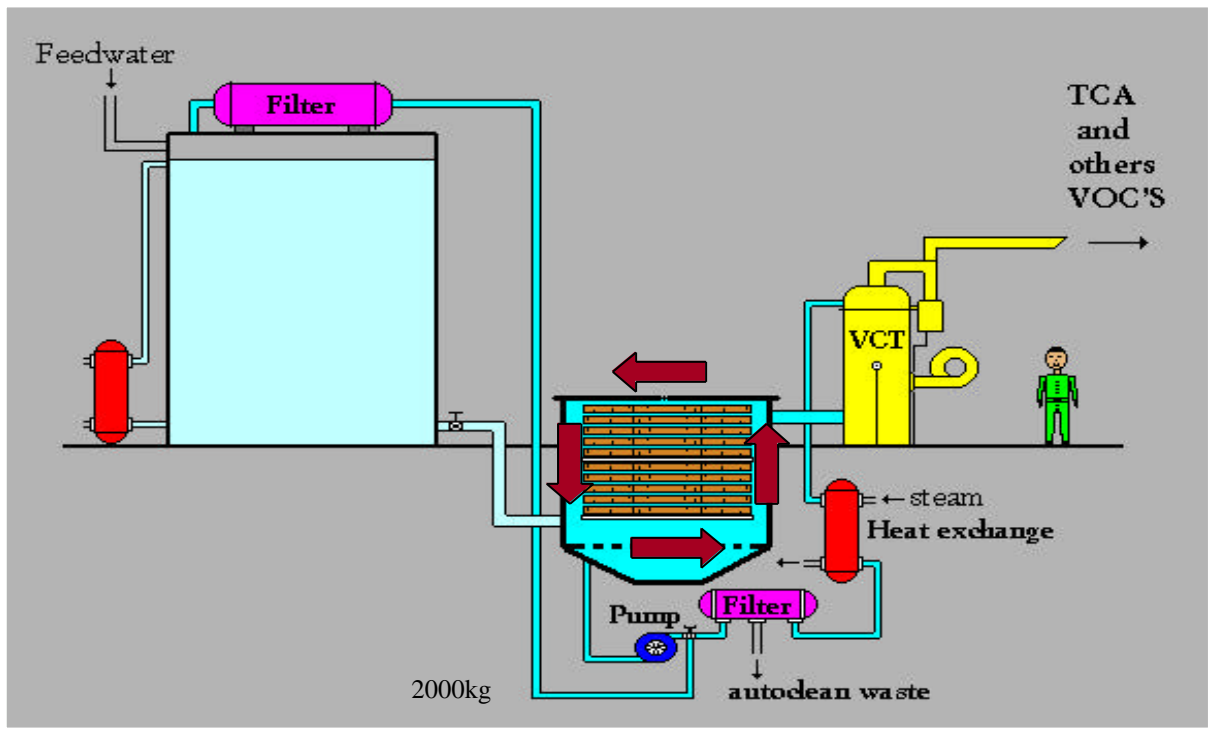
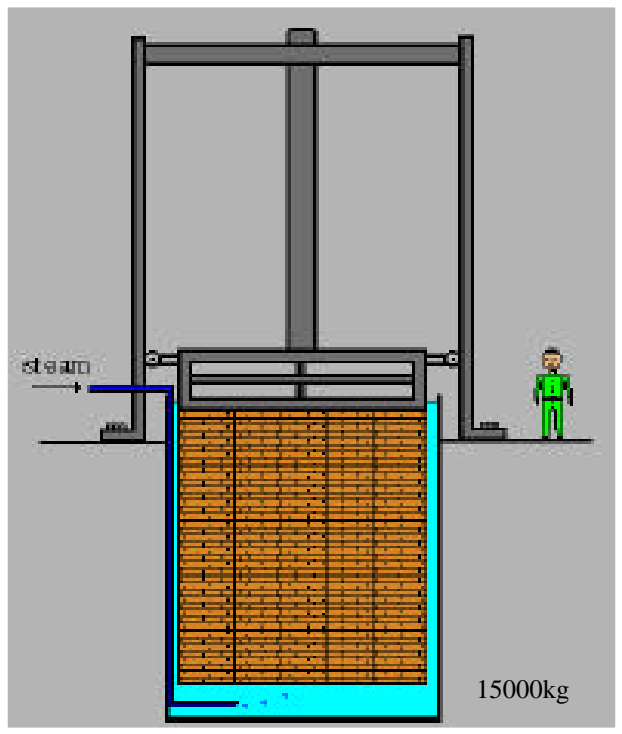
# Seasoning: Old versus new



# Boiling: Old versus new



# Boiling: Old versus new



# Chlorine eliminated from groundwater



## GROUNDWATER ANALYSIS

Parameter	Maximum admissible amount <sup>1.</sup>	Result
2,4,6 – TCA	0.002µg/L	n.d. <sup>2.</sup>
2,4,6 – TCP	0.02µg/L	n.d.
2,4,6 – TeCP	0.05µg/L	n.d.
PCP	0.1µg/L	n.d.
Total extractable organochlorine	0.024 mg/L Cl	–
Total preselected pesticides	0. 5µg/L	n.d.

1. Maximum admissible amount under C.E. Liege Code of Cork Manufacturing Practice (2,4,6 TCA and chlorophenols) and Portuguese Government Directive 75/440 (other parameters)

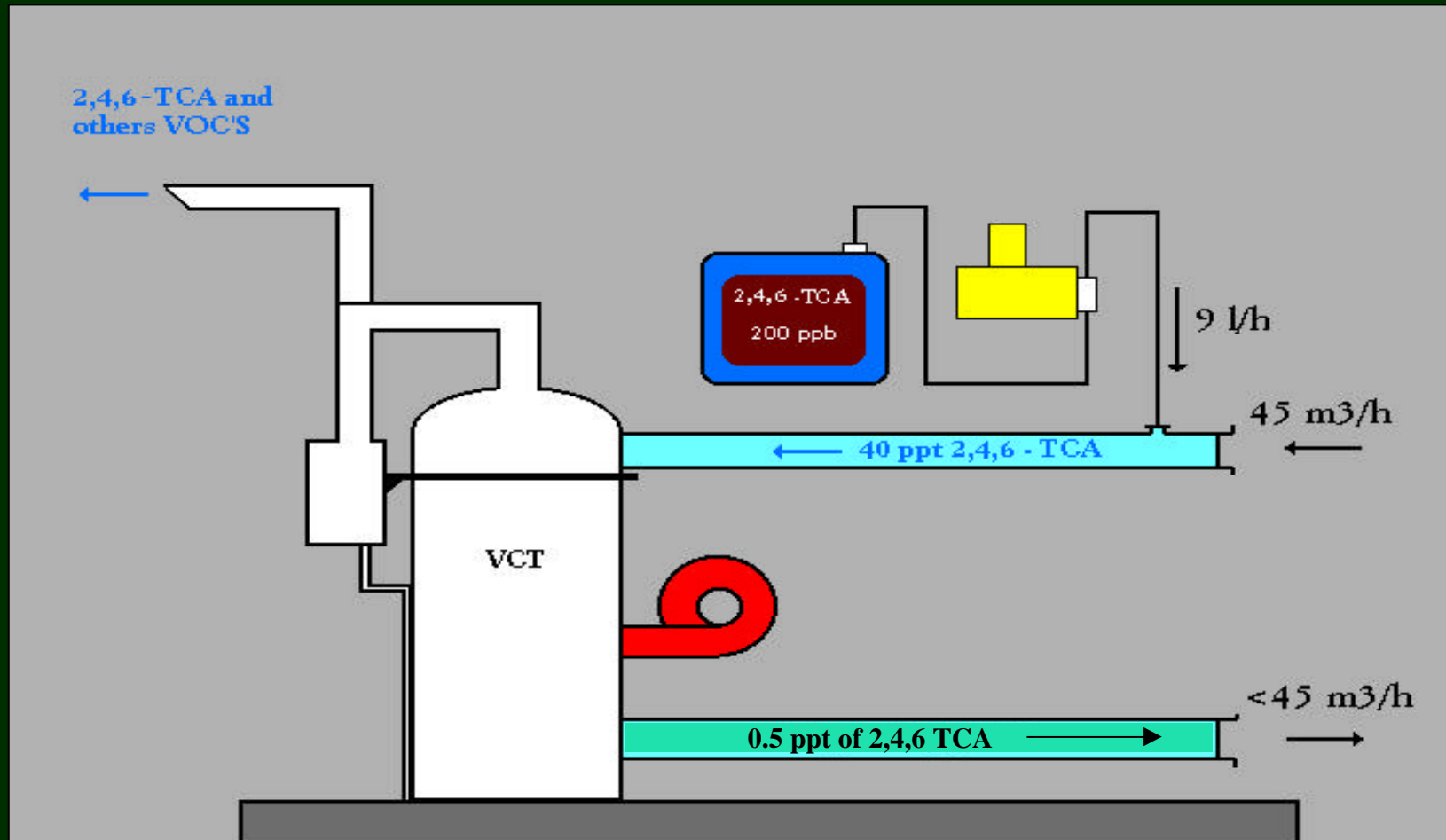
2. n.d = not detected

Source: CTCOR

# VCT: Continuous extraction of volatile organic compounds



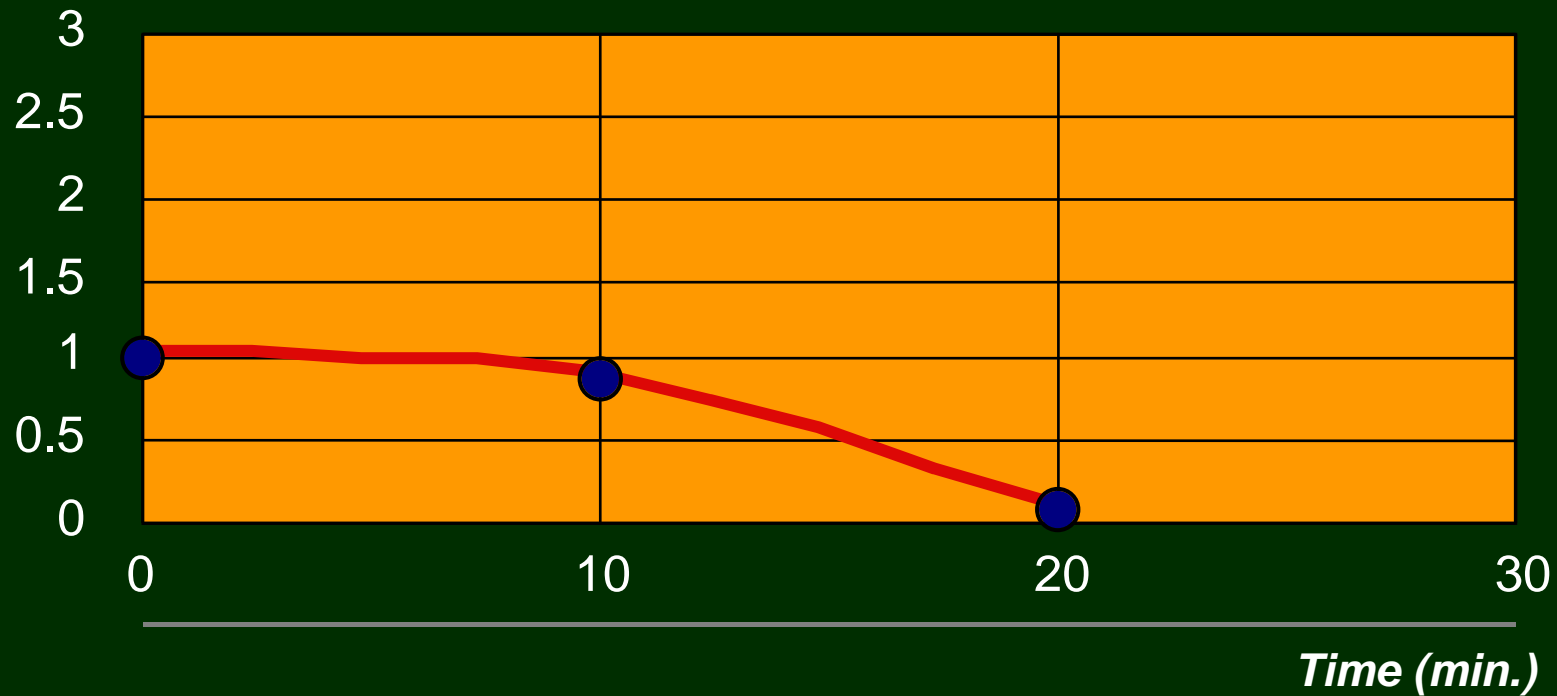
# VCT: Continuous extraction of volatile organic compounds



# VCT trial: TCA reduced by over 97 percent

REDUCTION IN 2,4,6 TCA AFTER VCT  
(SPME - GC - MC analysis)

*ppt of TCA*

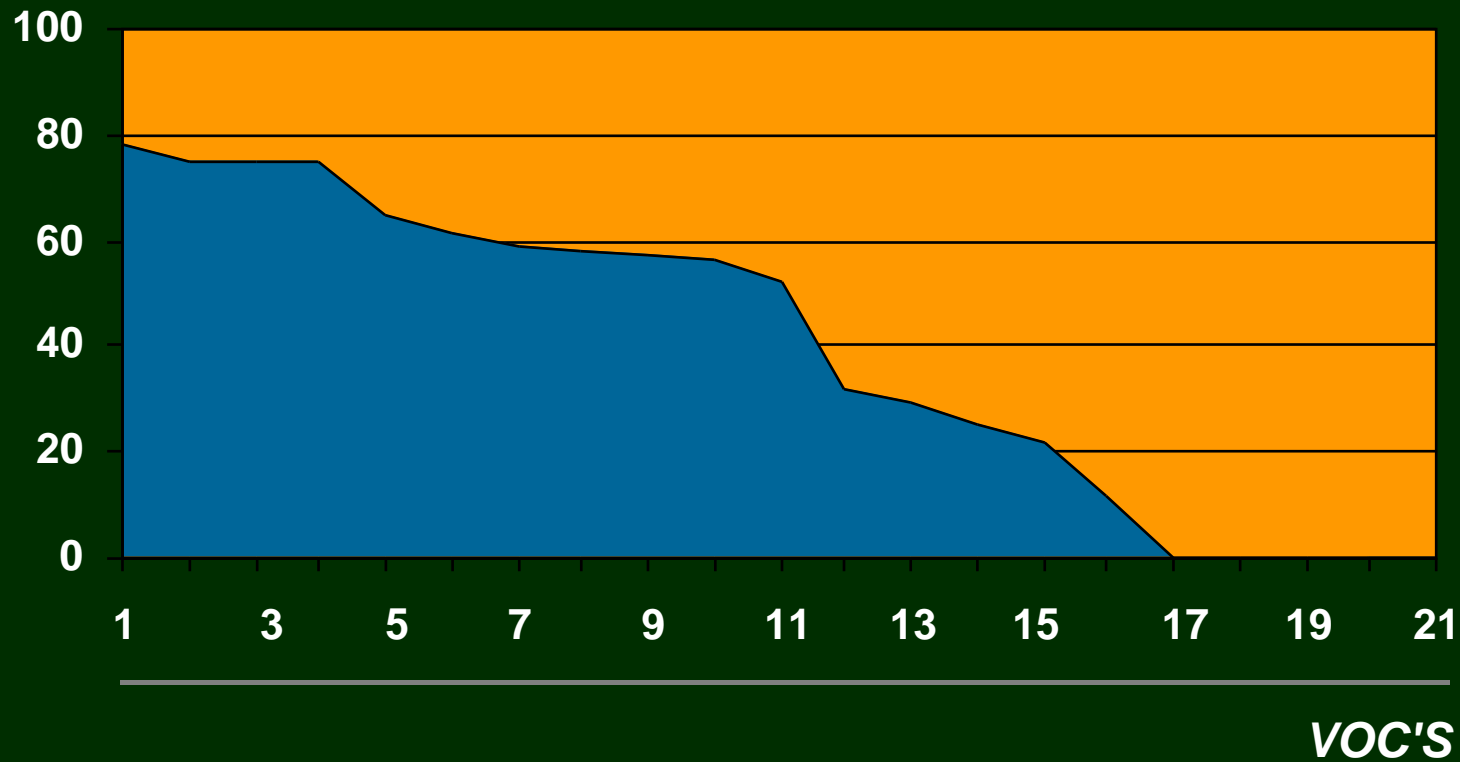


Source: Amorim trial

# Significant reduction in other VOC's

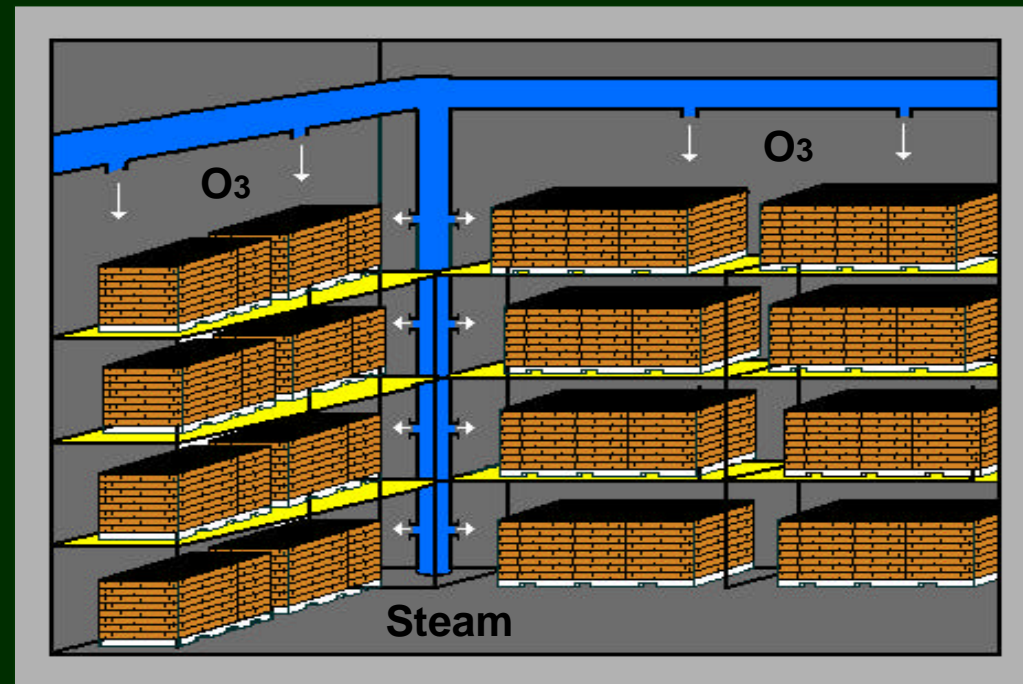
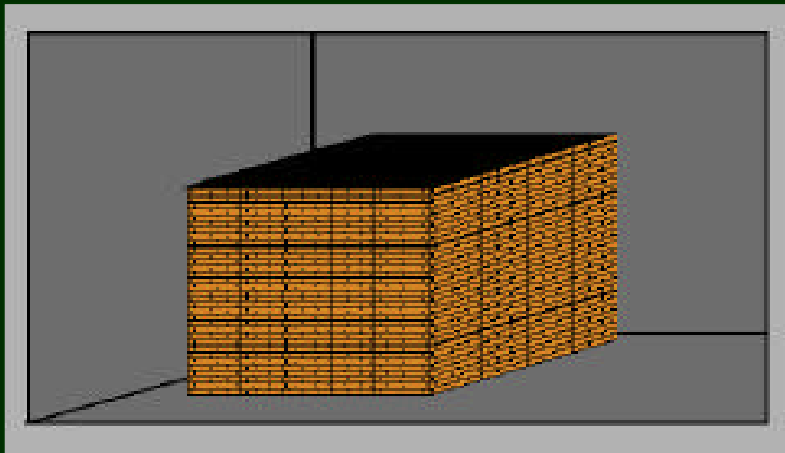
PERCENT REDUCTION IN VOC'S AFTER VCT  
(SPME - GC - MC analysis)

*Percent*



Source: Amorim trial

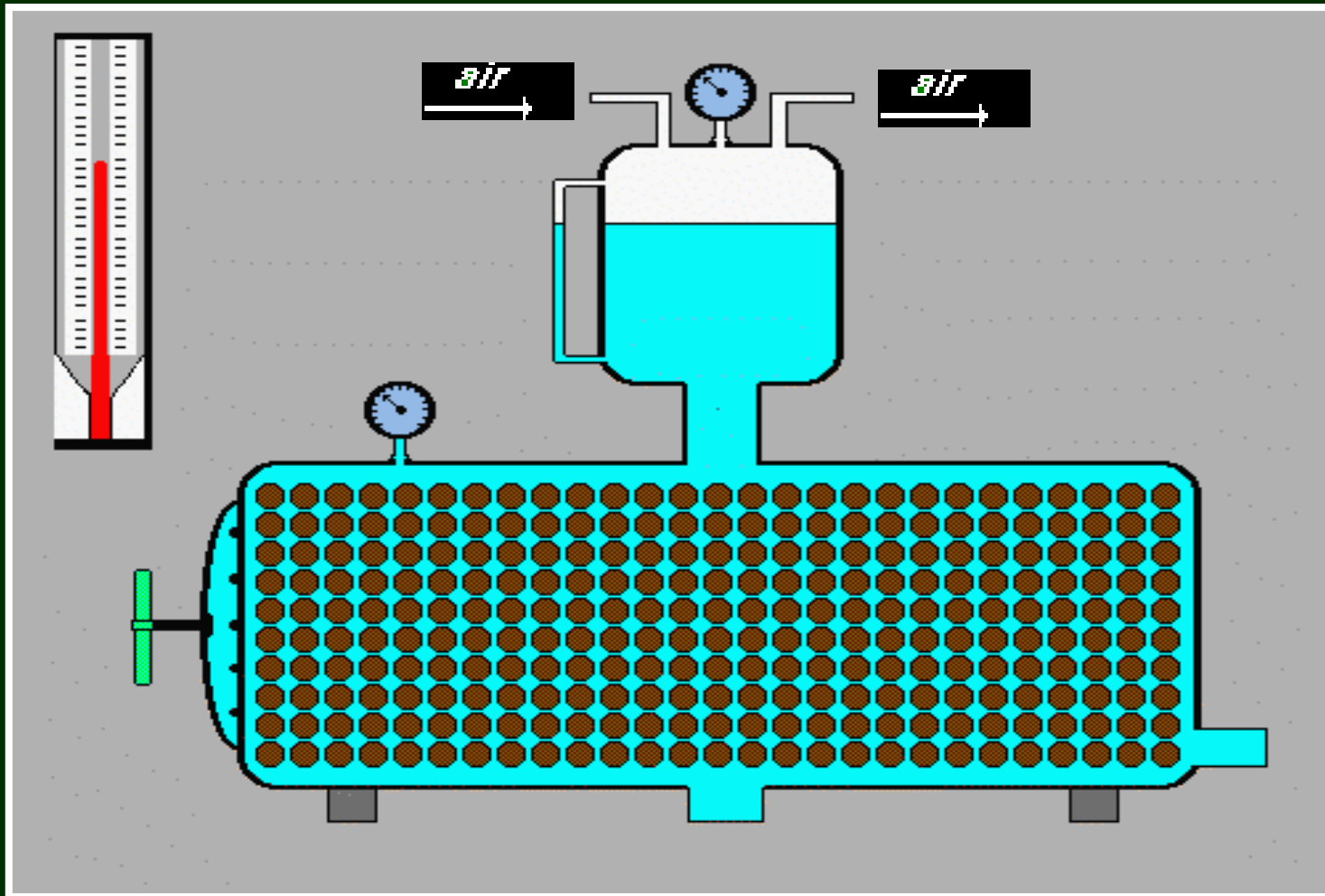
# Stabilization: Old versus new



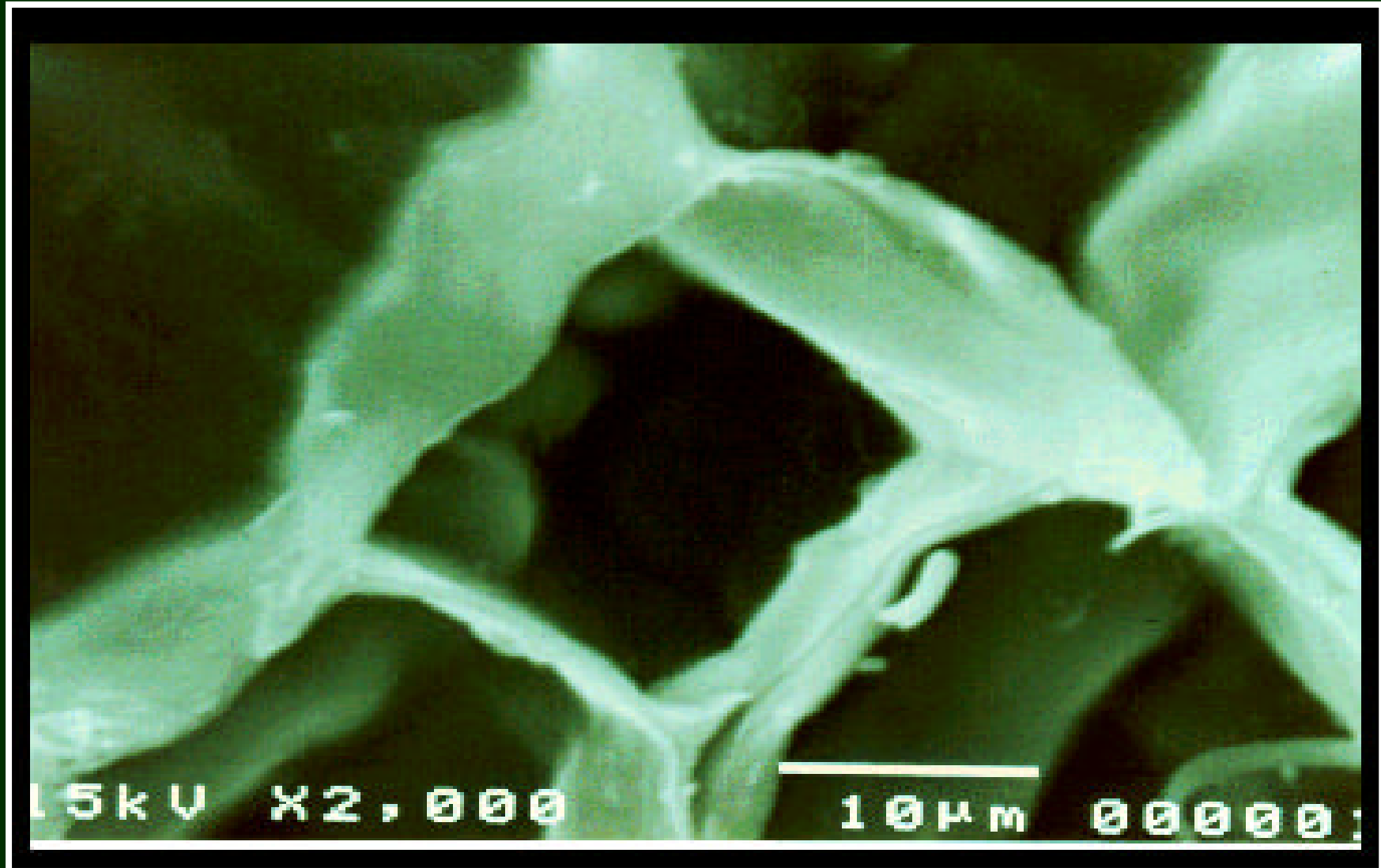
# The INOS system



# The INOS system



# Microscopy techniques used to monitor cell structure

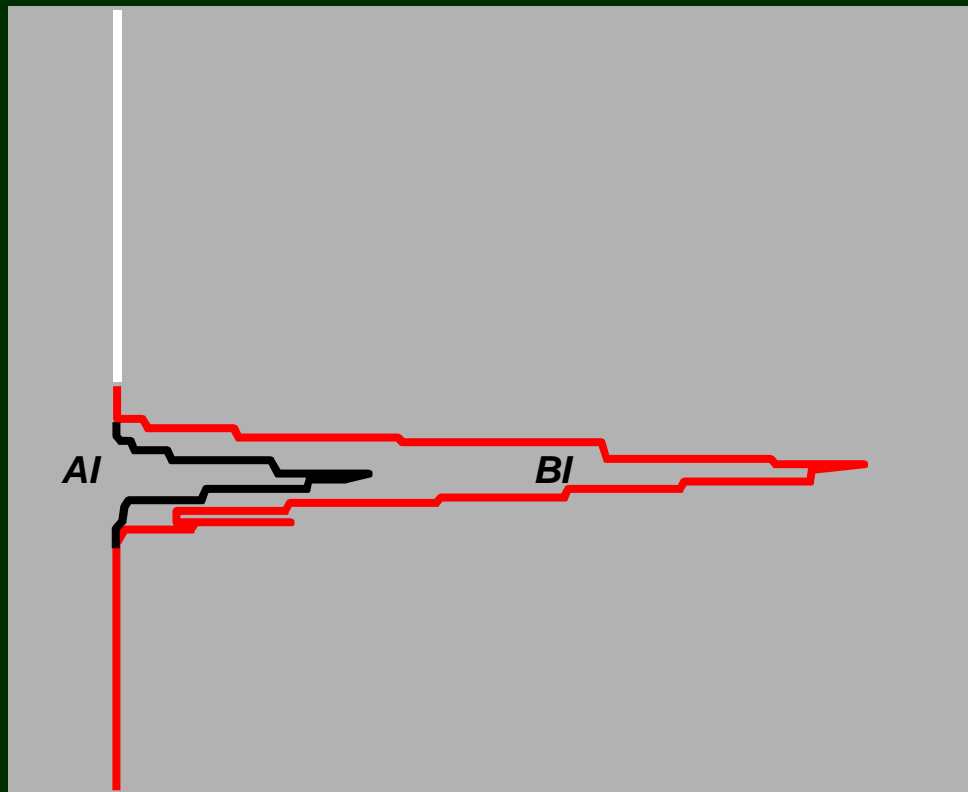


# 50 percent reduction in tannins post INOS

REDUCTION IN TANNIC ACID WITH INOS II  
(HPLC analysis)

BI = Before INOS II

AI = After INOS II



Area BI = 235,845

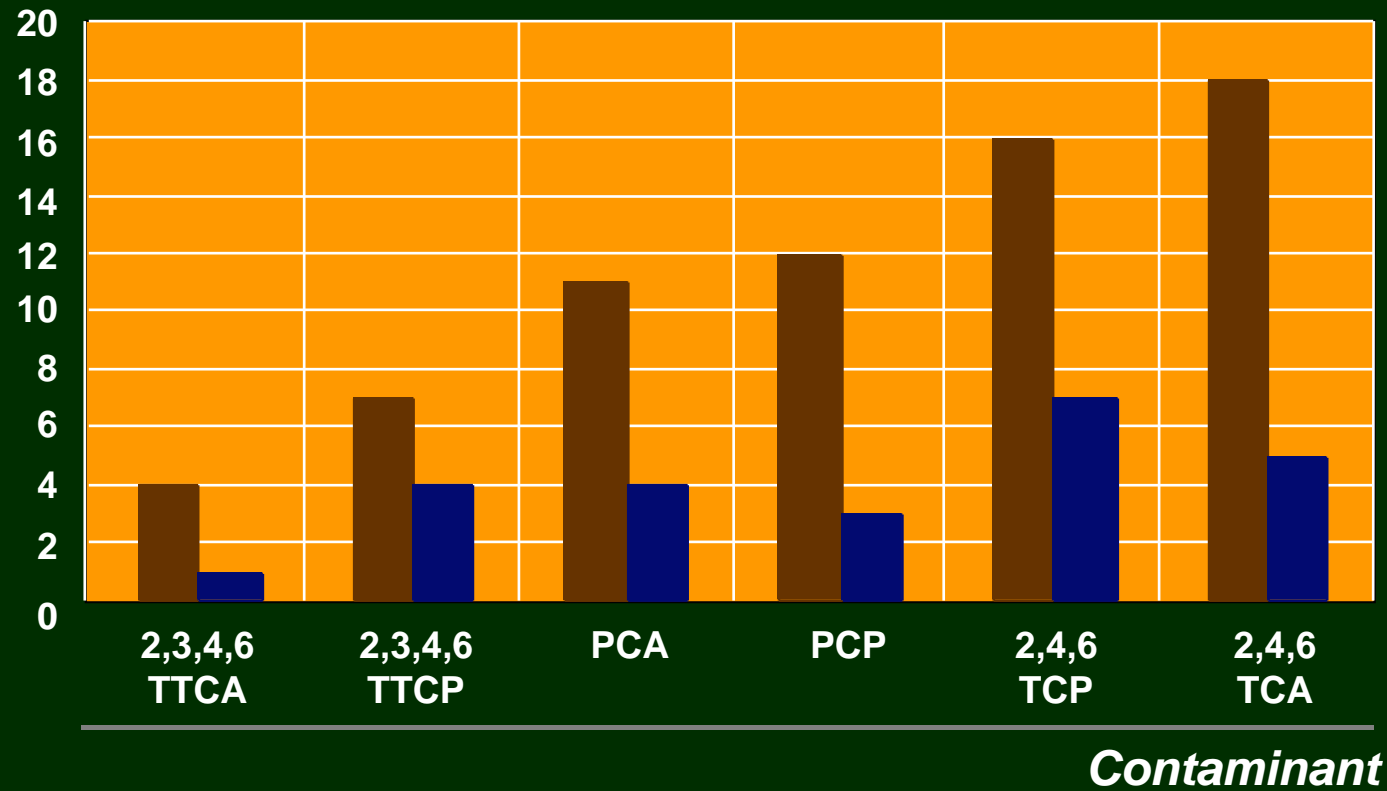
Area AI = 123,692

AI/BI = 0.52

# Huge reductions in TCA and other VOCs post INOS

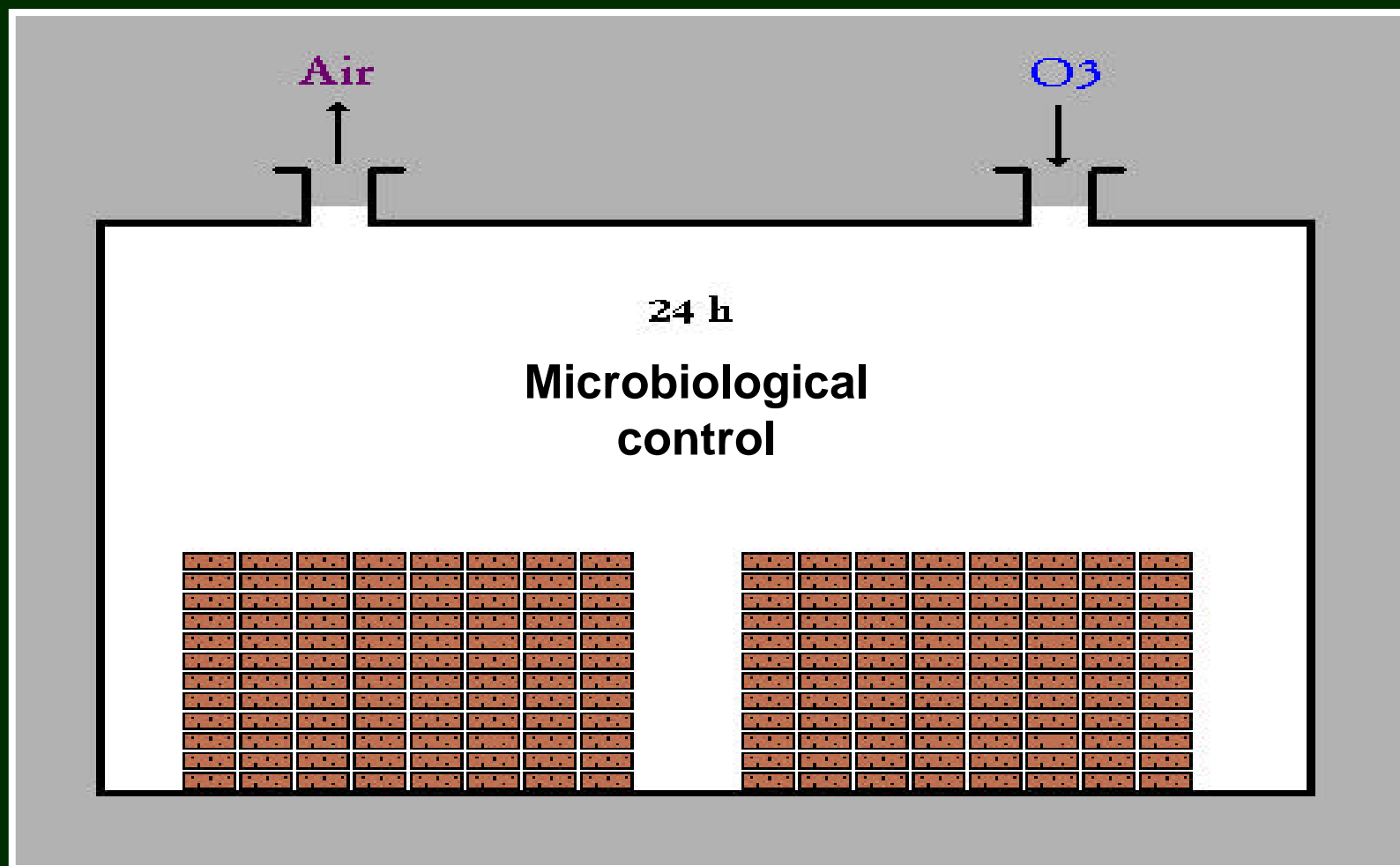
PRESENCE OF CONTAMINANTS  
ng/Kg

Before INOS II  
After INOS II



Source: Amorim trial analysis

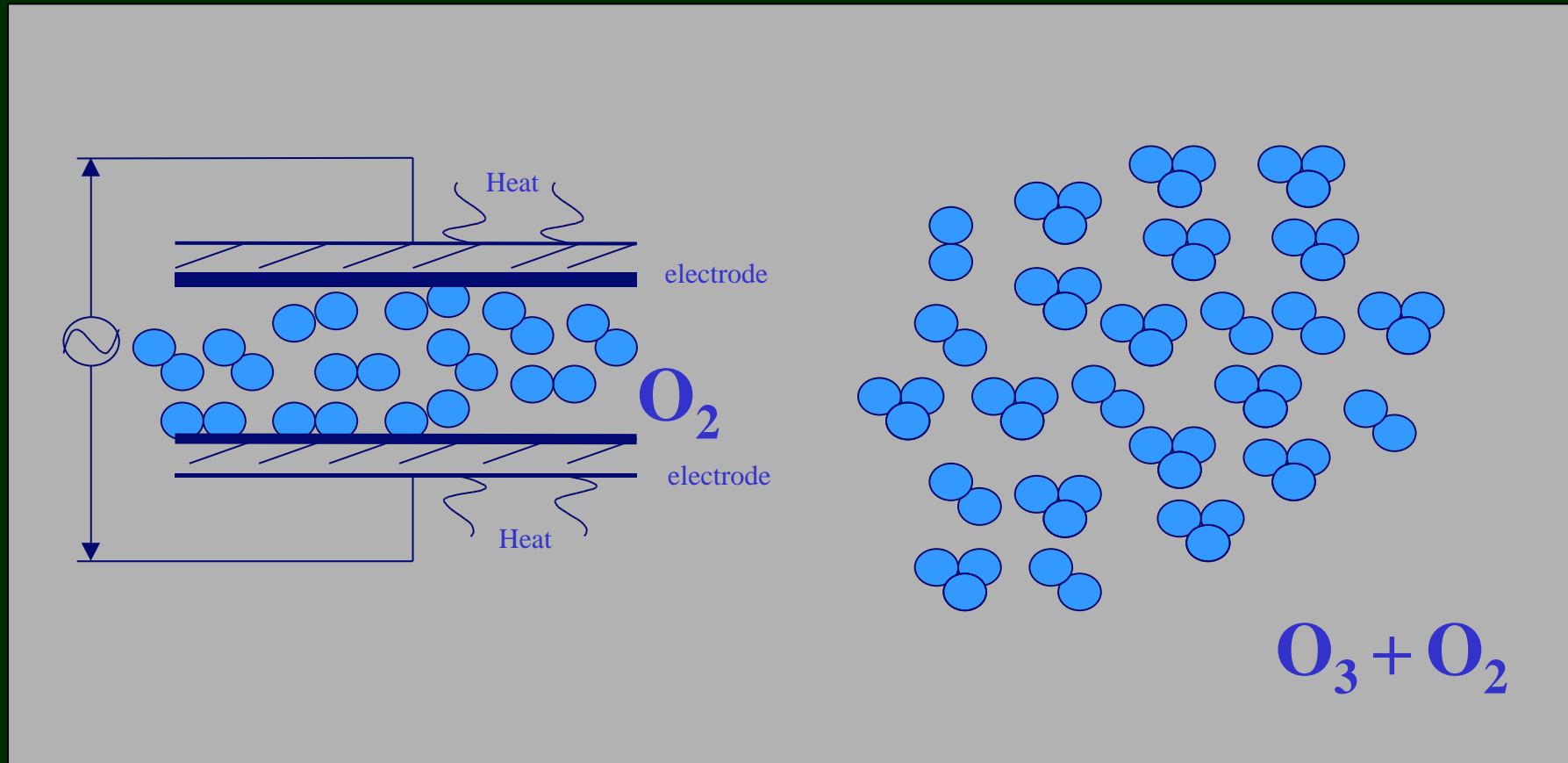
# Ozone treatment chamber



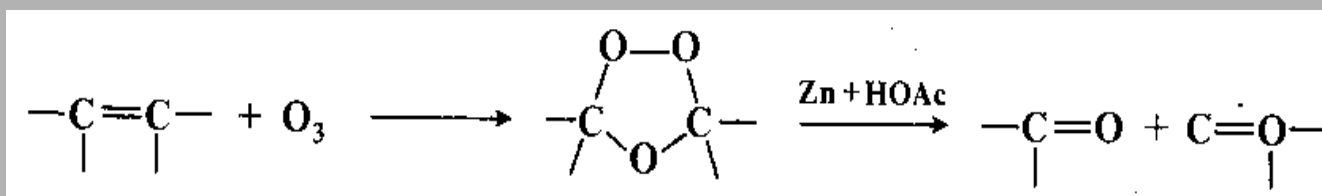
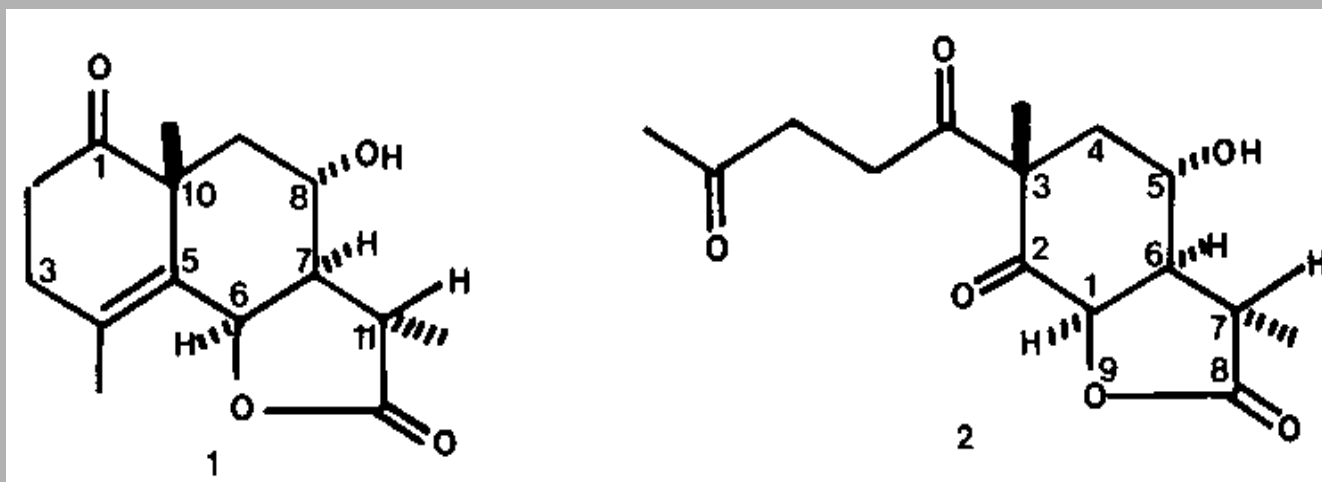
# Ozone use within Amorim



# Ozone generation



# Ozone as an oxidant



# Ozone as a disinfecting agent

	Time of contact (minutes)	Reduction of bacterial load (%)
<b><i>S. tiphimurium</i> 1. + O<sub>3</sub> (9 mg/h)</b>	0.25	99.7
	2.5	99.9
	10	99.9
	20	100
	30	100
<b><i>E. coli</i> 2. + O<sub>3</sub> (55.2 mg/h)</b>	0.25	100
	2.5	100
	10	100
	20	100
	30	100

1. ATCC 14028 3.2 x 10<sup>6</sup> CFU/ml

2. ATCC 14028 3.8 x 10<sup>6</sup> CFU/ml

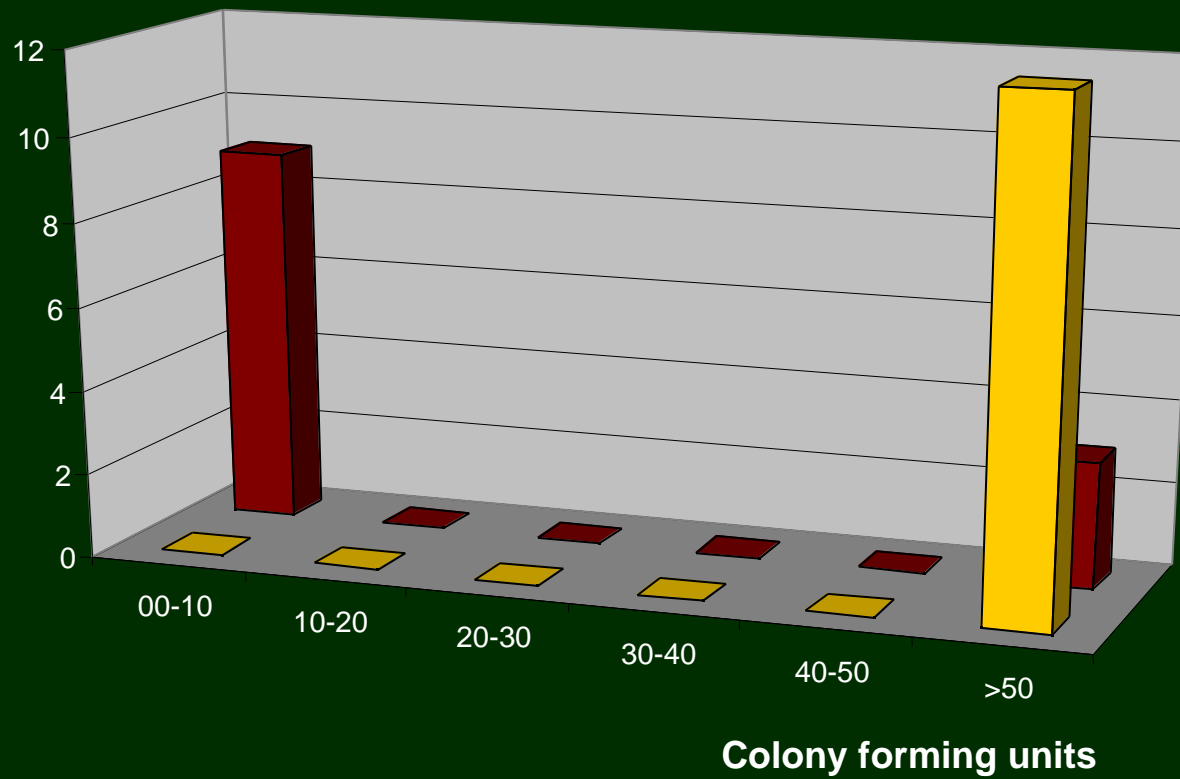
Source: Luengo and Casteastillo

# Experiment 1

## MICROBIAL GROWTH: CORK QUARTERS

Without Ozone  
2h after Ozone

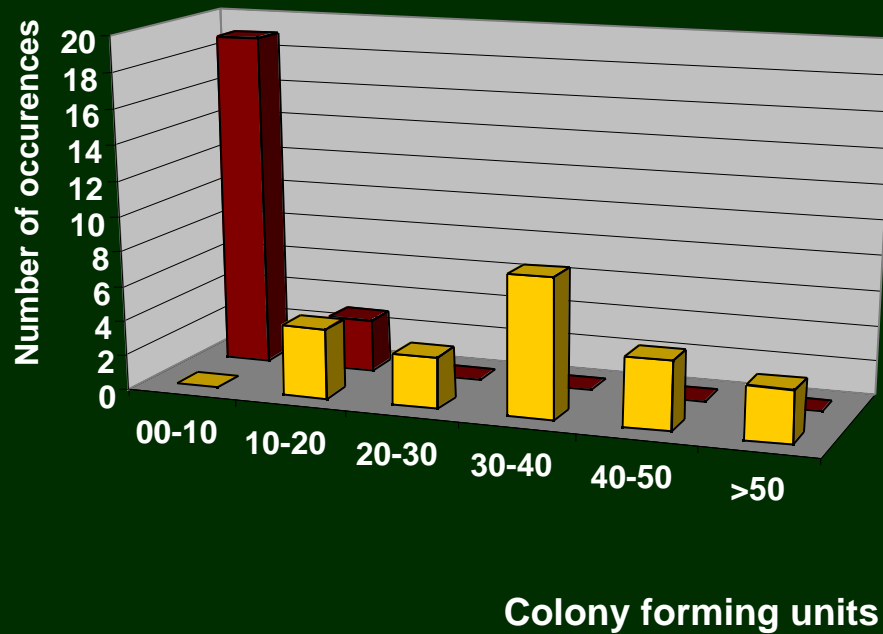
Number of occurrences



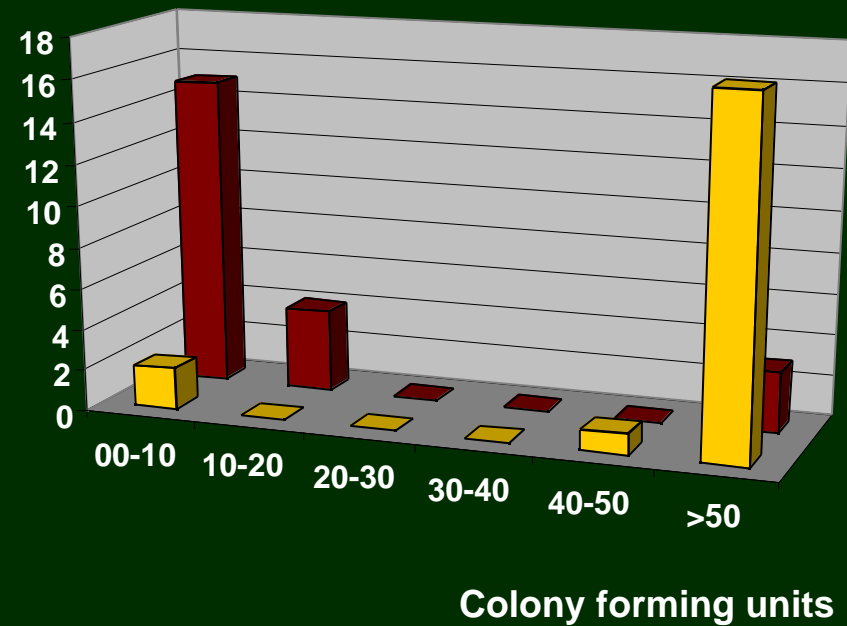
# Experiment 2

Without Ozone  
2h after Ozone

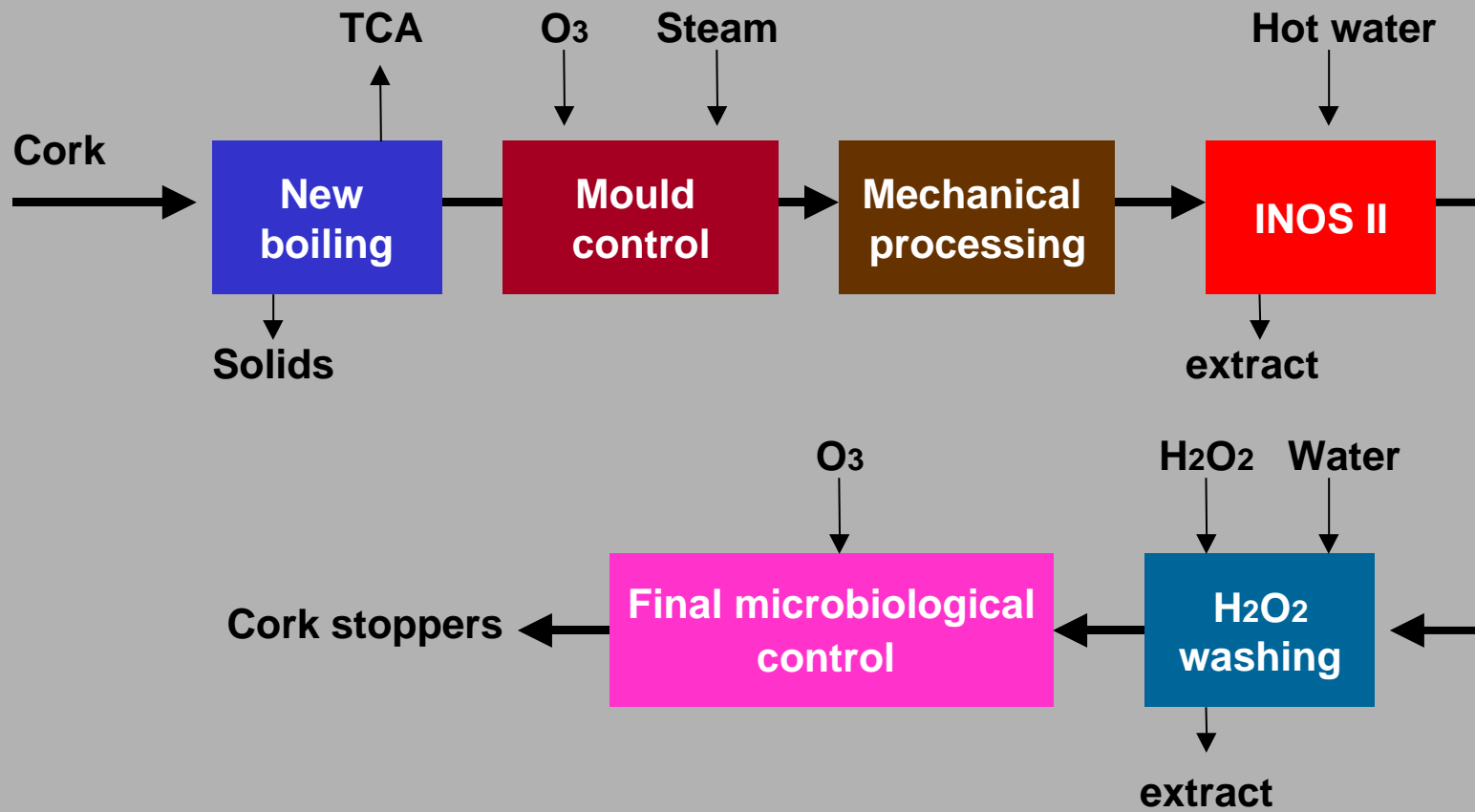
## MICROBIAL GROWTH: ENTIRE CORKS



## MICROBIAL GROWTH: CORK CORE



# Amorim new production process



# Amorim R&D summary

## Program

## Achieved

## In progress

- INOS II for Twin Top® & SPARK®
- INOS II for natural & granulated corks
- New boiling process
- Post-boiling stabilisation in ozone
- Controlled rehumidification to replace second boiling
- Ozone treatment of washing water
- Ozone treatment of finished corks
- Natural suberin-based glue
- Single unit, water-based colmatage



- Introduced for bar top corks

- Due June 2000

- In development

- Due September 2000

# Focus of internal R&D program

- **Cork database**
- **Scientific validation**
  - Processes
  - Effectiveness of cork in long term wine storage
  - New products
- **Code of practice for corking**
- **Cork flavours**
  - Critical risk analysis in production chain
  - New technologies to minimise risk
- **Sensory analysis**
  - Expert panel, uniform standards

# Collaborative research projects

## Institution

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- UC Berkeley (USA)
- ETS (USA)
- Cyrano Sciences (USA)
- Ascent Lab (USA)
- IBET (Portugal)
- Excell Laboratory (France)
- Geisenheim Institute (Germany)

## Study

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- Breakdown of TCA chain
- TCA analysis, new product testing
- Electronic nose technology
- Standards for cork flavours, panel
- Product conformity to standards
- Investigation of moulds
- Comparative closure study
- Comparative closure study

# Collaborative research projects (cont.)

## Institution

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- University of Bordeaux 2
- Wacker (Germany)
- Darex (France)
- Novo Nordisk (France)
- University of Aveiro (Portugal)

## Study

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- Role of cork in wine preservation and development
- New product development (protection against contaminants)
- As above
- Enzyme treatment
- Natural cork-based adhesives

# Conclusion

- **Cork will continue to improve its technical performance**
- **Amorim's efforts beginning to bear fruit**
- **Amorim committed to working in partnership with the wine industry**