'Latest Advances in Cork Processing Technology'

Workshop

12th Australian Wine Industry Technical Conference

Melbourne, 25 July 2004

Current research issues:

Cork's role as a wine closure

AMORIM

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CURRENT AREAS OF RESEARCH

TCA	• Origin of TCA • Preventive measures
Oxygen permeability	• Micro-oxygenation?
New glues	• Agglomeration • Discs

FORMATION OF 2,4,6-TCA FROM 2,4,6-TCP IN THE PRESENCE OF CORK MOULDS

MOULDS	TCA (w/o TCP) (ng / gr cork)	TCA (with TCP) (ng / gr cork)	Bio-conversion TCP to TCA (%)	Growth in cork	
Sterile cork	9.9	10.1	0.0	ND	Non-producers
Mucor plumbeus	6.3	6.6	0.3	-	
Mortierella alpina	5.5	6.6	0.1	-	
Penicillium decumbens	9.5	10.6	0.1	-	
Verticillium psalliotae	6.5	75.5	6.9	+	Low-level producers
Penicillium chrysogerum	9.7	86.5	7.7	+	
Paecilomyces viridis	9.9	88.7	7.9	+	
Chrysonilia sitophila	18.0	128.2	11.0	+	Medium-level producers
Penicillium purpurogenum	6.4	116.6	11.0	+	
Penicillium citreonigrum	11.0	143.8	13.3	+	
Acremonium strictum	11.0	153.4	14.2	+	
Cladosporium oxysporum	12.4	155.5	14.3	+	
Trichoderma viride	7.2	278.9	26.2	+	High-level producers
Fusarium oxysporum	6.0	292.5	28.7	+	
Trichoderma longibrachiatum	20.5	396.1	37.6	+	

Source: Coque, Juan José Rubio, 'Origin and biosynthesis of TCA in cork', paper presented to oenology seminar, *Anisoles and Brettanomyces, causes effects and control mechanisms*, Foundation for Wine Culture, Madrid, 15 January 2004.

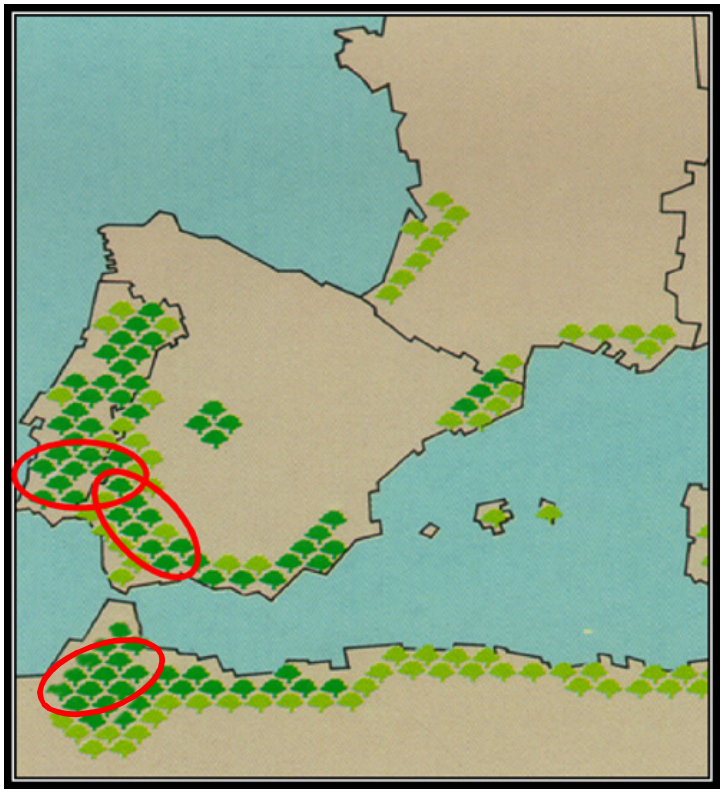
TCA FORMATION: TCP KEY PRECURSOR

Precursor	Sodium hypochlorite	T. longi-brachiatum	2,4,6-TCA (ng/ g cork)	Bio-conversion of precursor in TCA* (%)
2,3-DCP	-	+	8.0	0
2,3-DCP	+	+	9.6	0.10
2,3-DCP	+	-	8.0	0
2,4-DCP	-	+	4.5	0
2,4-DCP	+	+	8.9	0.03
2,4-DCP	+	-	4.7	0
2,5-DCP	-	+	7.2	0
2,5-DCP	+	+	9.7	0.11
2,5-DCP	+	-	15.5	0.83
2,6-DCP	-	+	6.2	0
2,6-DCP	+	+	3.1	0
2,6-DCP	+	-	3.2	0
3,4-DCP	-	+	8.3	0
3,4-DCP	+	+	9.1	0.05
3,4-DCP	+	-	6.8	0
Hexaclor.exano	-	+	7.0	0
Hexaclor.nceno	-	+	7.0	0
PCP	-	+	9.7	0.11
PCA	-	+	7.3	0
2,3,4,6-TeCP	-	+	9.9	0.13
2,3,4,6-TeCA	-	+	4.6	0
2,3,6-TCP	-	+	1.5	0
2,4,5-TCP	-	+	7.5	0
2,4,6-TCP	**-**	**+**	**355.8**	**34.72**
Anisole	-	+	8.8	0
Anisole	+	+	18.8	1.02
Anisole	+	-	15.5	0.69
Phenol	-	+	17.4	0.88
Phenol	+	+	25.2	1.66

* traces of TCA in cork

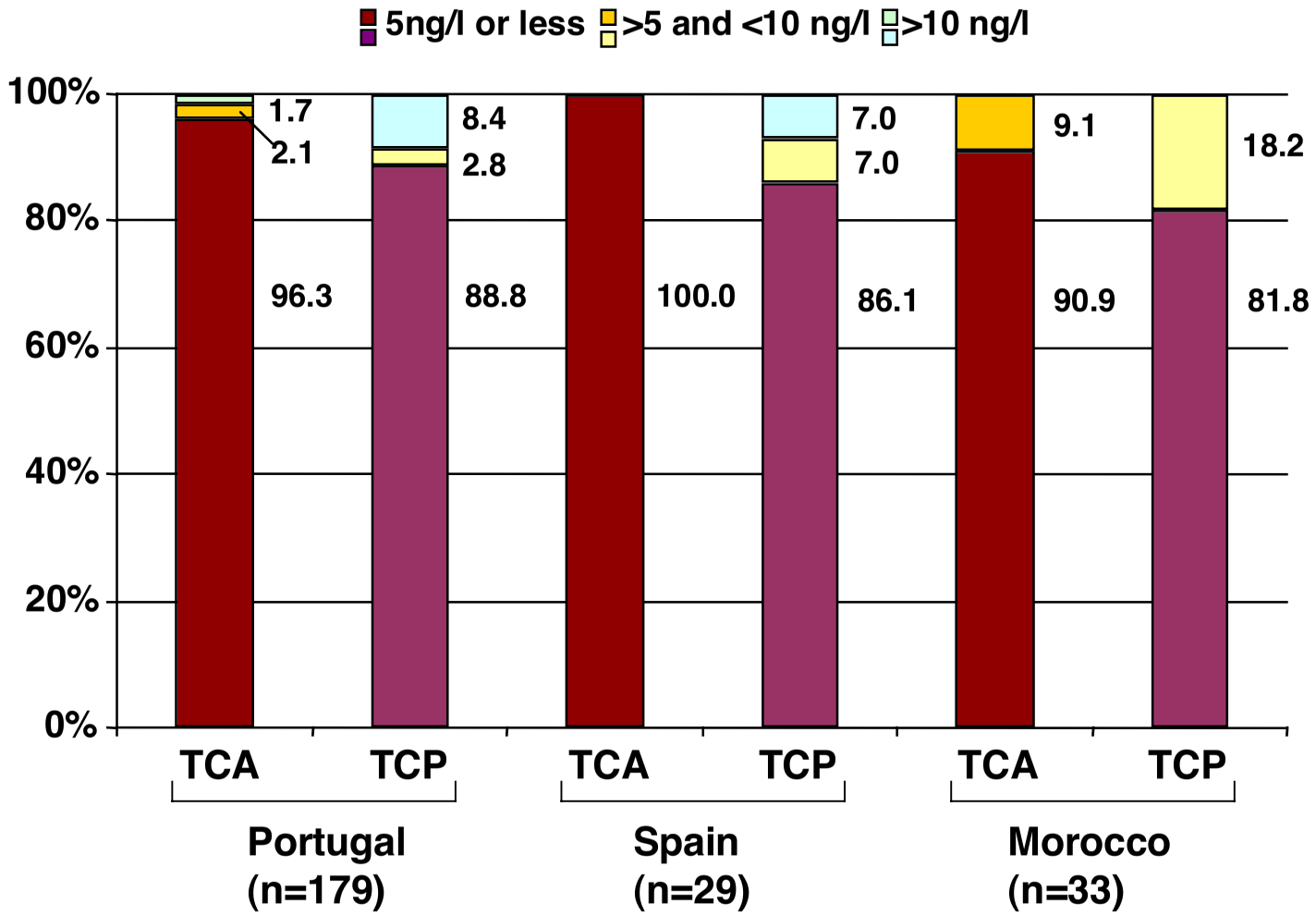
Source: Coque, Juan José Rubio, 'Origin and biosynthesis of TCA in cork', paper presented to oenology seminar, *Anisoles and Brettanomyces, causes effects and control mechanisms*, Foundation for Wine Culture, Madrid, 15 January 2004.

STUDYING PREVALENCE OF PRECURSORS



- GC-MS analysis for chlorophenols and chloroanisoles
- Samples from edge and interior of each cork pile pre-boiling
- Random samples of thin and thick cork

PREVALENCE OF TCA AND TCP IN CORK FORESTS



POSSIBLE PREVENTIVE MEASURES

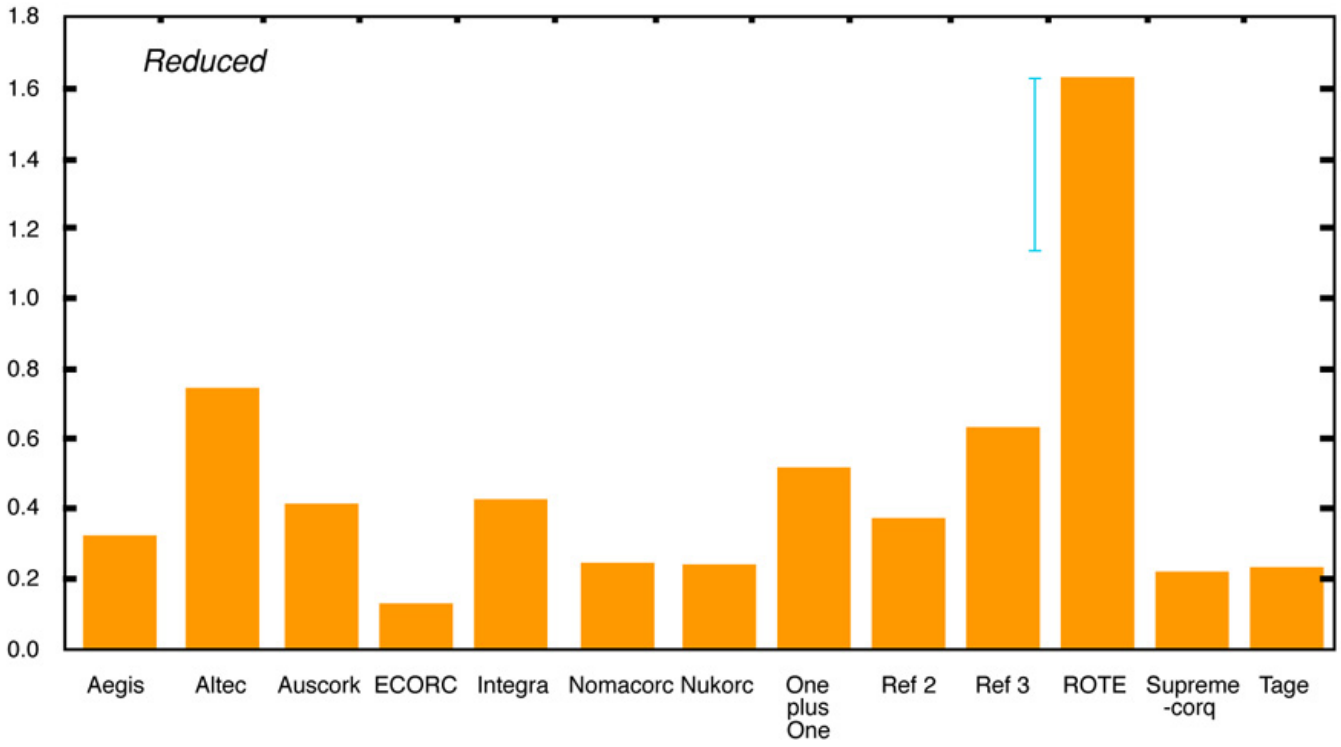
1. Bio-remediation in cork forests (Amorim, IBET Portugal and Universitá Cattolica Sacro Cuore - Italy)
   - Characterise forest mycobiotica
   - Identify common moulds able to transform polychlorinated phenols without forming TCA

2. Genetically modified mould strains able to degrade polychlorinated phenols without forming TCA

OXYGEN PERMEABILITY OF CORK

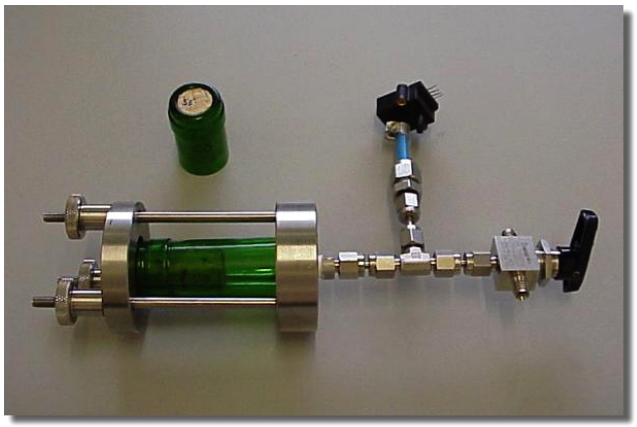
Can cork stoppers allow micro-oxygenation of the wine?

REDUCTIVE CHARACTERS IN SOME ROTE-SEALED WINES



Source: GODDEN P., FRANCIS P., GISCHEN M., COULTER A., VALENTE P., HOJ P. and ROBINSON E. 2001, 'Wine bottle closures: Physical characteristics and effect on composition and sensory properties of a Semillon wine', *Australian Journal of Grape and Wine Research*, 7, p.97.

RESEARCH INTO OXYGEN PERMEABILITY



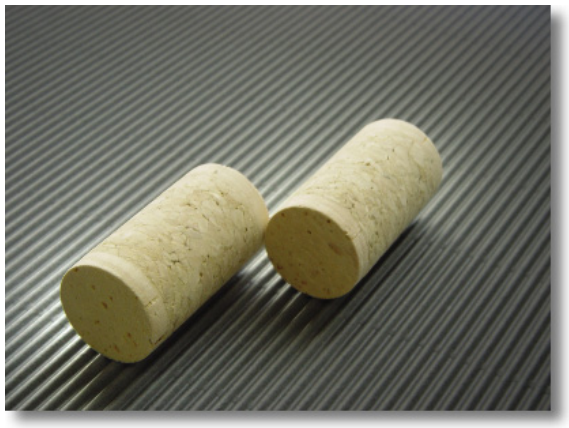
Permeability of cork stoppers (Faculty of Engineering University of Porto)

- Determine best measure of permeability
  - Time lag or Wicke–Kallenbach
- Identify source of permeating gas
  - Oxygen in cork or atmosphere?

Bottling experiments (University of Bordeaux)

- White and red wines
- Various closures (cork & synthetic)
- Various storage conditions

BETTER AND CHEAPER GLUES



- Agglomeration
- Discs

	Base
Traditional	Polyurethane
	Casein
New	Aliphatic iso-cyanates
	Ethylene vinyl acetate
	Latex

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