A BRIEF OVERVIEW OF MALOLACTIC RESEARCH AT OARDC

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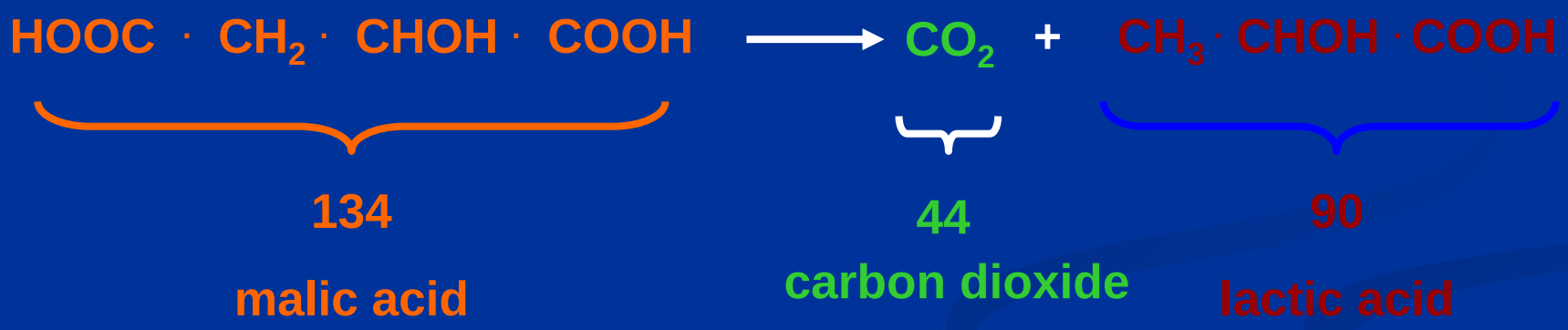
Malolactic Fermentation

- Process of degrading L - malic acid to L+ lactic acid and carbon dioxide by certain lactic acid bacteria
- Strains of Interest - *Oenococcus oeni:*
  - *(*formerly *Leuconostoc oenos)*
- Not really a 'fermentation' as no energy is produced – pronounced pinpoint bubbles
- Reduction of acidity by 1-3 g/L

THE CHEMISTRY...



stronger acid	weaker acid
2 carboxyl groups	1 carboxyl group

Malolactic Fermentation

- Due to cool climate growing conditions producing wines of high acidity MLF provides a natural way of deacidification
- May aid in added complexity benefiting certain wine varieties and styles in both aroma and flavor profile – flavor components e.g. diacetyl
- Tends to make wine more microbial stable

Malolactic Fermentation (Critical Parameters)

- Chemical/Physical:
  - SO_2 , temperature, pH and alcohol content
- Nutrients:
  - From lees, micronutrients
  - Do not utilize ammonia
- Microbiological:
  - Competing with natural and inoculated yeast strain, in addition to other bacteria e.g. (*Lactobacillus kunkeii)*

Overview of Three Studies

- Effect of Bacterial Strain on The Rate of ML Fermentation
- Effect pH and Sulfur Dioxide on the Rate and Completion of MLF in Pinot Gris Wines
- Effect of pH and Temperature on the Rate and Completion of MLF in Chardonnay Wines

Effect of Bacterial Strain on the Rate of ML Fermentation

Enology Materials and Methods

- Cabernet Franc (2001) and Chambourcin (2002) fruit was harvested at full maturity from OSU/OARDC vineyard in Kingsville, OH
- Grapes cooled overnight at 35°F
- Grapes were crushed and destemmed treated with 50 ppm sulfur dioxide

Enology Materials and Methods

- Must fermented to dryness at 90°F with Lalvin ICV®-D254 yeast strain
- The wine was pressed and divided into 7 triplicate lots
- Five of the seven lots were inoculated with a commercial direct inoculation malolactic bacteria strain

Enology Materials and Methods

- Remaining two lots served as controls at 35°F and 70°F
- After ML completion the wines were racked, sulfited, cold stabilized and bottled

Must Analysis

- °Brix
- pH
- Titratable acidity

Wine Analysis

- pH
- Titratable Acidity
- Sulfur Dioxide
- Volatile Acidity
- Alcohol
- Color
  - (Hue & Intensity)
- Paper Chromatography
  - ML rate
- L malic acid
- Sensory evaluation

Must Composition for Cabernet Franc and Chambourcin

Season	pH	%TA g/100ml	°Brix
Cabernet Franc			
2001	3.26	0.99	22.2
Chambourcin			
2002	3.04	0.89	20.0

Effect of Bacterial Strain on the Rate of MLF in Cabernet Franc Wines 2001 Season

Malolactic Strain	Days to Completion
Control 70° F	24
Enoferm Provino	6
Enoferm D	3
MBR – EQ54	6
MBR – OSU	6
Vinoflora Oenos	12

Effect of Bacterial Strain on the Rate of MLF in Chambourcin Wines 2002 Season

Malolactic Strain	Days to Completion
Control 70° F	36
Enoferm Provino	7
Enoferm D	7
MBR – EQ54	10
MBR – OSU	24
Vinoflora Oenos	10

Malic Acid Concentration of 2001 Cabernet Franc Wines

2001 Cabernet Franc	
Bacterial Strain	L Malic Acid (g/L)
Enoferm Provino	0.044
Enoferm D	0.077
MBR – EQ54	0.041
MBR – OSU	0.039
Vinoflora Oenos	0.043
Control 75° F	0.047
Control 35° F	2.071

Malic Acid Concentration of 2002 Chambourcin Wines

2002 Chambourcin Wines	
Bacterial Strain	L Malic Acid (g/L)
Enoferm Pro Vino	0.126
Enoferm D	0.099
MBR EQ54	0.091
MBR OSU	0.071
Vinoflora oenos	0.056
Control 75° F	0.054
Control 35° F	2.382

Sensory Paired Comparison Test for Cabernet Franc ML Inoculated Wines

Paired Samples	# of Preferred Samples Taste **
Control vs Natural	12 vs 30
Control vs Enoferm Pro.	8 vs 34
Control vs Enoferm D	4 vs 38
Control vs MBR EQ54	7 vs 35
Control vs MBR OSU	5 vs 37
Control vs Vinoflora Oenos	8 vs 34

Sensory Paired Comparison Test for Chambourcin ML Inoculated Wines

Paired Samples	# of Preferred Samples Taste**
Control vs Natural	10 vs 32
Control vs Enoferm Pro.	7 vs 35
Control vs Enoferm D	3 vs 39
Control vs MBR EQ54	5 vs 37
Control vs MBR OSU	7 vs 35
Control vs Vinoflora Oenos	7 vs 35

Conclusions

- There appears to be differences in bacterial rates of ML inoculated fermentations on Cabernet Franc and Chambourcin
- Preliminary sensory trials of taste indicate the preference of all direct inoculation strains over the control
- Enoferm D has completed ML fermentations quickest in both Cabernet Franc and Chambourcin while being chosen most for preference in relation to the control

Effect of Bacterial Strain on the Rate and Completion of MLF in Pinot Gris Wines 2004 Season

Must Composition for 2004 Pinot Gris Study

°Brix	pH	%TA g/100ml
20.5	3.25	0.92

Effect of Bacterial Strain on the Rate of MLF in 2004 Pinot Gris

Malolactic Strain	Days to Completion
[a]Control 70° F	X
Enoferm® Alpha	62
Enoferm® Beta	35
Enoferm® D	35
Lalvin MBR® 31	36
Lalvin MBR® VP-41	35
Vinoflora® CH-35	24

[a]Indicates did not complete MLF at 90 days

Effect of pH and SO_2 on the Rate and Completion of MLF in Pinot Gris Wines

Materials and Methods

- 2004 Pinot Gris juice was adjusted to pH levels: 3.0, 3.2, 3.4, and 3.6 and transferred to 4 sub-lots
- SO_2 levels were added at a rate of 0, 20, 40, and 60 ppm into each pH treatment
- The juice was inoculated with Wadenswil 27 and fermented to dryness

Materials and Methods

- At Dryness, each lot was inoculated with Vinoflora CH-35 and placed at 70°F
- MLF was monitored by paper chromatography for absence of malic acid

2004 Pinot Gris Must Data

°Brix	pH	%TA g/100ml
19.2	3.26	0.65

Effect of pH and SO_2 Levels on Days to Complete MLF

Must pH	Sulfur Dioxide Levels (ppm)			
	0	20	40	60
3.0	X	X	X	X
3.2	15	16	45	45
3.4	9	13	23	41
3.6	9	9	14	22

[x]Malolactic fermentation did not occur in 98 days

Conclusions

- Results indicated that the wines with a must pH value of 3.6 finished MLF the earlier over all SO_2 treatments
- As SO_2 concentration increased there was a delay in the rate of MLF completion over all pH treatments
- It is important to note that the wine with a must pH treatment of 3.0 did not complete MLF across all SO_2 treatments

Effect of pH and Temperature on the Rate and Completion of MLF in Chardonnay Wines

Materials and Methods

- 2005 Chardonnay grapes were crushed, pressed and treated with 50 ppm SO_2
- The juice was adjusted to pH levels: 2.95, 3.14, 3.31, and 3.50
- The Juice was inoculated with Wadenswil 27 and fermented to dryness at 70°F

Materials and Methods

- At dryness, the wines were inoculated with Vinoflora CH-35 and placed in separate temperature treatments of 55, 63, 70, and 80°F for malolactic fermentation
- MLF was monitored by paper chromatography for absence of malic acid

2005 Chardonnay Must Data

°Brix	pH	%TA g/100ml
21.0	3.38	0.82

Effect of pH and Temperature on Days to Complete MLF

[a]Must/ [b]Wine pH	Malolactic Fermentation Temperatures			
	55	63	70	80
2.95/3.12	56	27	19	56
3.14/3.31	34	19	12	15
3.31/3.45	34	15	12	12
3.50/3.65	27	15	12	12

[a]Indicates must pH
[b]Indicates wine pH prior to MLF

Conclusions

- Similar results were observed in the must pH of 3.45 and 3.65 in correlation to MLF rate of completion
- Wines at pH of 3.12 took the longest to complete MLF over all temperature treatments
- In reference to temperature, wines held at 55°F took much longer to complete MLF for all pH treatments
- Wines that went through MLF at 80°F appeared to have sensorial perception of lacking fruit structure in both aroma and flavor in addition to an acetaldehyde perception

THANK YOU!

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