

Acid Management of Must and Wine

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Major Acids in Grape Must and Wine

- Predominate acids found in must and wine
 - Tartaric acid
 - Malic acid
 - These acids account for over 90% of the total acids found in juice

Acidity

- Responsible for wine freshness, tartness and crisp taste.
- Wine of high acidity may appear to be very tart or puckery.
- Wine of low acidity may appear to be flat or insipid.

Acid Adjustment

- Acid adjustments should not be based on % TA and the influence of acids on taste alone.
- Juice and wine acids directly effect wine pH.

Juice and Wine pH

- Monitoring juice and wine pH is important to help determine ripeness of the grape, color stability of the must and wine along with chemical and microbial stability.

Juice and Wine pH

- pH refers to a measurement of acidity or alkalinity on a numerical scale
- pH measures the total acid content while titratable acidity measures only those acids available to bond with the NaOH that we use to titrate the sample
- It is advisable to have must pH below 3.5 prior to initiating primary fermentation

Classifying Acidity and pH Conditions (Boulton, 1984)

- Low TA and high pH
- Moderate TA and pH
- High TA and low pH
- High TA and high pH
- ($TA < 6 \text{ g/L}$) ($pH > 3.5$)
- ($TA 6 - 9 \text{ g/L}$) ($pH 3.0 - 3.5$)
- ($TA > 9 \text{ g/L}$) ($pH < 3.0$)
- ($TA > 9 \text{ g/L}$) ($pH > 3.5$)

Acid Addition

- Must with low TA and high pH
 - Acid adjustment through blending
 - Acid adjustment by adding tartaric acid
 - Stronger acid with greater pH reduction
 - Relatively non-metabolic compared to malic or citric acid
 - Large acid adjustments recommended to the must/juice instead of the wine
 - Fine tune acid adjustments to the wine
 - May also use small amounts of citric acid at this point

Cool Climate Viticulture Areas

- Excess acidity at harvest may occur in cool climate viticultural areas requiring deacidification of the must or juice.

Excess Harvest Acidity

- Common for cool climate viticultural areas.
- Viticultural practices – overcropping, unorganized spray program, etc...
- Vine vigor – high vigorous vines typically produce higher acidities.
- Excess acidity may require deacidification.

Methods of Deacidification

- Amelioration
- Chemical neutralization and precipitation of tartrates
- Choosing an acid reducing yeast strain
- Anion exchange
- Performing a Malolactic Fermentation
- Blending
- Sugar Addition

Amelioration and Chaptalization

- Amelioration is defined as the addition of sugar and or water to the must or fermenting wine.
- Chaptalization refers to the addition of sugar to the must.

Amelioration

- In cool climate winemaking regions grapes commonly contain insufficient sugar and excess acidity.
 - A common practice to add sugar and water to the must or fermenting wine is implemented.

Amelioration

- Amelioration with water is not recommended for high quality wines.
- Amelioration with water to must or wine may reduce aroma, flavor, color and varietal characteristics.
- Recommended only for certain labrusca style varieties.

% Amelioration Needed In Reducing Must Titratable Acidity

$$A - B = C \quad C/A = \text{desired \% amelioration}$$

Where: A = actual TA (g./100ml.)

B = desired TA(g./100ml.)

Amelioration – Legal Limits

- TTB limits amelioration based on the final fixed acid content not being reduced below 5.0 g./ L.
- Maximum amount of amelioration material permitted in grape and most fruit wine may not exceed 35 % (vol./vol.) of the total ameliorated volume.
- Refer to TTB 27 CFR, part 24, section 24.178.

Use of Potassium Bicarbonate in Chemical Deacidification

- Useful in must with a high TA and low pH.
 - % TA of 8-10 g/L and low pH of 3.0 or below.
- Recommended over potassium carbonate.
- Typically .9 g/L will reduce the TA by approximately 1g/L in must or wine.
- Add to clarified must or fined and filtered wine.

Advantages of Using Potassium Bicarbonate

- Elements are naturally occurring in must and wine. ($K^+ + HT^- \leftrightarrow KHT$)
- Dissolves rapidly with complete precipitation of KHT upon cold stabilization.
- Exhibits the ability to be utilized with other deacidification procedures.
 - (malolactic fermentation and amelioration)

Disadvantages of Using Potassium Bicarbonate

- Use of potassium bicarbonate in high acid must and wines is not effective in reducing the acidity adequately without raising the pH excessively.
- Potassium bicarbonate is temperature and time specific.

Use of Calcium Carbonate in Must and Wine Deacidification

- Recommended for large acid adjustments of 2 g/L and higher. (TA above 9 g/L)
- Addition rate of .67 g/L will approximately reduce TA by 1 g/L in must or wine.
- Large acid additions are recommended for must where smaller additions can be made to fined and filtered wine.

Advantages of Using Calcium Carbonate

- Provides a maximum acid reduction with a minimal increase in pH.
- No cooling required for precipitation of calcium tartrate.
- Removal of some malic acid during reaction at pH of 4.5 or higher with the double salt procedure.

Disadvantages of Using Calcium Carbonate

- Precipitation of calcium tartrate is slow typically (6-8 weeks) and unpredictable.
- Potassium ions in juice can interfere with the calcium carbonate reaction causing insufficient deacidification.
- Excess calcium carbonate can raise must or wine pH to unacceptable levels as well as introducing a salty or soapy taste.

Double Salt Deacidification

- Used for musts with a high TA and high pH.
- It's our understanding at the OARDC that "Acidex" is no longer being produced.
- Similar results have been reported from Cornell with the use of calcium carbonate alone and monitoring pH of the reaction.
- Must and wine pH is critical in the formation of calcium malate and calcium tartrate.

Double Salt Procedure

- A portion of clear must (10%) to be treated is slowly added to calcium carbonate while mixing forming a slurry.
- Monitor and maintain pH at 4.5 or higher.
- Continue stirring adding the rest of the must (90%) to be treated while monitoring pH.
- The crystalline double salt is removed by filtration.
- Blend filtered must with the untreated portion.

Advantages of Using Double Salt Deacidification

- Theoretical yield of (1:1) in tartaric and malic acid removal.
- Application successful in both must and wine.
- Provides better wine stability than single salt method.
- Speeds up removal of calcium tartrate.

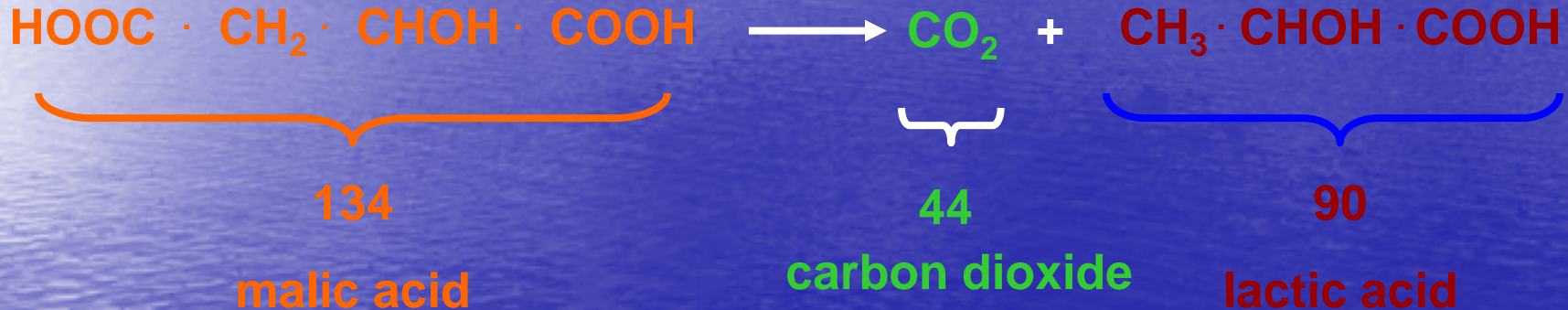
Disadvantages of Double Salt Deacidification

- Procedure requires more specific attention and difficulty.
- Initial must and wine acid profiles should be analyzed.
- Acid reduction of wine that has undergone malolactic fermentation will not work.

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

2 carboxyl groups

weaker acid

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 e.g. diacetyl
- Tends to make wine more microbial stable

Blending

- Effective and efficient way to reduce wine acidity while adding complexity
- Perform blending trials on 100 ml samples
- Cold stabilization must be done after blending trial due to the change in wine chemistry after blending

Pearson Square

Wine A %TA
1.0

Target – Wine B %TA
0.1

Target %TA = 0.7

Wine B %TA
0.6

Wine A – Target %TA
0.3

After subtraction we blend 1 part wine A with 3 parts wine B in obtaining our target of 0.7 %TA

Sugar Addition

- The addition of sugar prior to bottling can work wonders in lessening the sense of acidity in a wine
- The addition of .25 percent or higher sugar depending on variety and style can be effective
- Bench trials on 100 ml samples must be done to check for balance and perceived acid loss

THANK YOU!

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