PURDUE UNIVERSITY

PURDUE EXTENSION

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Commercial Winemaking Production Series

Preventing Refermentation

Residual sugar and malic acid can cause fermentation of bottled wine

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EXPERT REVIEWED

How much residual sugar will cause visible yeast growth or carbonation in the bottle?

Residual sugar

The recognition threshold for sweetness from residual sugar (R.S.) in a dry wine of average acidity is about 5 g/L (0.5 percent), while concentrations of 1 to 4 g/L can smoothen a wine without making it taste off-dry. In very acidic wine styles these numbers are significantly higher, and a *méthode traditionelle* sparkling wine may taste *brut* even at 15 g/L R.S.

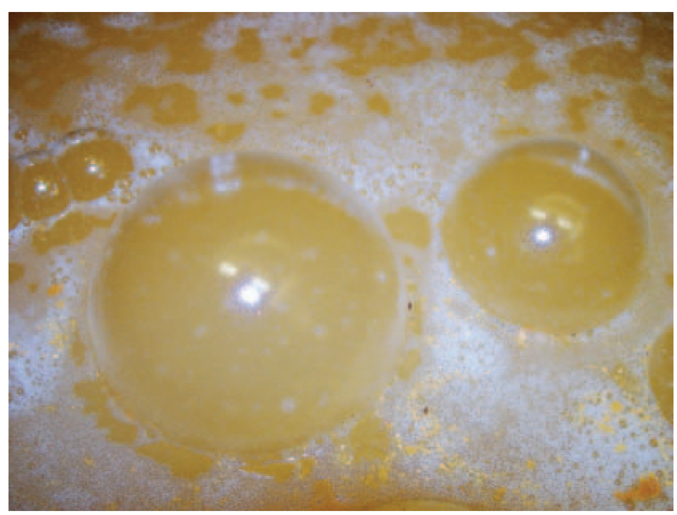
Microbial stability

Sensory perception of dryness is quite different from microbial stability of a particular wine, and it cannot be used as a gauge for refermentation potential. After fermentation, a wine is commercially considered dry when its combined *Saccharomyces*-fermentable sugars (glucose and fructose) are below 1 g/L (0.1%). If the winery laboratory tests for R.S. by measuring all reducing sugars, including pentoses, then 2 g/L (0.2%) is the common upper limit for a dry wine.

Those numbers practically assure that the wine is safe from noticeable refermentation, i.e. cell growth and carbonation by *Saccharomyces* yeast strains. Nonetheless, any R.S., even down to 0.2 g/L, can still serve as a substrate for wine microbes such as *Brettanomyces* yeast or lactic acid bacteria.

Gas production

Glucose and fructose are converted into roughly half ethanol and half carbon dioxide, i.e., 1,000 mg/L residual fructose can produce almost 500 mg/L CO_2 gas. The solubility of CO_2 in wine is very high compared to other gases such as nitrogen or oxygen. A carbonation that is strong enough to push corks would occur beyond the saturation concentration of about 1,400 mg/L at room/bottling temperature (20˚C). Whether the carbonation is sufficient



Gas bubbles on fermenting wine

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to push out a cork is strongly influenced by bottle headspace volume and closure type. A perceivable spritz may be tasted at 800 mg/L CO_2, which would require 1.6 g/L refermentable fructose or glucose.

Haze formation

Saccharomyces may grow if the recommended doses of sorbate and sulfur dioxide are not met, or the sterile filtration prior to bottling was compromised. It has been reported that even 100 mg/L residual pentoses can lead to a visible *Brettanomyces* yeast haze if proper SO_2 management and filter integrity tests are not implemented. A visible haze due to the growth of *Saccharomyces* must certainly be expected above 1,000 mg/L R.S.

How much residual malic acid will cause visible malolactic bacteria growth or carbonation in the bottle?

Malic acid

Grapes at harvest contain between 0.6 and 6 g/L of malic acid, depending on the growing climate. Malic acid and tartaric acid are the main acids in grapes and wine, but wine bacteria cannot metabolize tartaric acid during the malolactic fermentation (MLF). Malolactic bacteria can turn malic acid into lactic acid and carbonic acid, which leaves the fermentor as carbon dioxide, thereby reducing the acidity of the wine.

Traditionally, the conversion of malic to lactic acid is monitored in the winery lab via paper chromatography. This method is semi-quantitative, and the absence of a malic acid spot on the chromatogram indicates a concentration of less than 30 mg/L, a barely visible one about 200 mg/L. It is commercially assumed that if a wine completes MLF, the residual malic acid is less than 300 mg/L or 0.3 g/L.

Gas production

Malic acid is stoichiometrically converted into two-thirds lactic acid and one-third CO_2, i.e., 300 mg/L residual acid could produce 100 mg/L gas. The solubility of CO_2 in wine is relatively high, and cork-pushing carbonation would occur only beyond the saturation concentration of about 1,400 mg/L at room/bottling temperature (20˚C). A perceivable spritz may be tasted at 800 mg/L CO_2, which would require the malolactic fermentation of 2.4 g/L malic acid.

Haze formation

MLF bacteria will grow based on residual nutrients in the wine if malic acid is present, and a visible haze in a white wine due to the growth of *Oenococcus oeni* can be expected above 300 mg/L (0.3 g/L).

References

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