Flavour management by citric acid negative MLF starter cultures

Authors: Carsten Heinemeyer, 2B FermControl; Ulrich Hamm DLR-RNH Bad Kreuznach; Dr. Jürgen Fröhlich, University of Mainz

The malo-lactic fermentation (MLF) is a commonly used method to convert the aggressive malic acid to lactic acid. This conversion results in a reduction of the titratable acidity, which is desired mainly in red wine but also in numerous white wines. This process will be done either by the indigenous flora of LAB or by selected strains of LAB e.g. *Oenococcus oeni*. During the MLF, *Oenococcus oeni* does not convert only malic acid into lactic acid, numerous amounts of aroma active by-products will also be produced. The best known is diacetyl, which gives buttery notes to the wine. Diacetyl will be produced during the MLF by the conversion of the natural citric acid in the wine by *Oenococcus oeni* (Jan Clair Nielsen 1999). Apart from the diacetyl formation by *Oenococcus oeni*, numerous intermediate by-products are produced through the metabolism of citric acid.

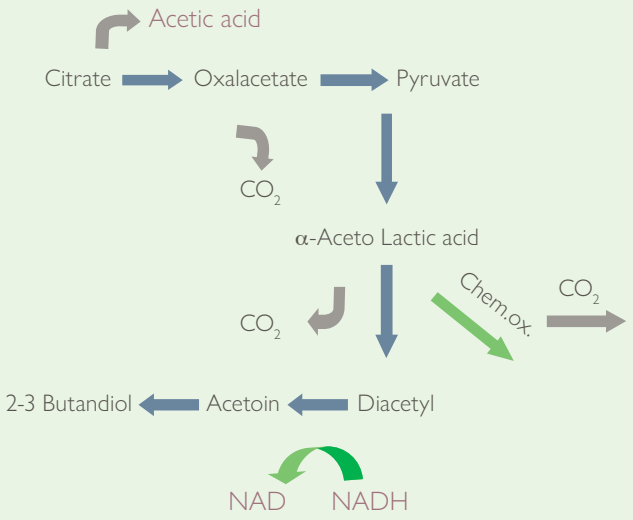
Today, it is a winemaker's desire to enhance or preserve the fruity varietal character of the wine. They wish to avoid the lactic notes without losing the other benefits of the MLF. In aromatic wines, such as Riesling or Sauvignon Blanc, the MLF character overlays the varietal character, which is undesired.

Aroma Profile of MLF and Timing of Inoculation

Figure 2. shows the citric acid metabolism of *Oenococcus oeni*. It is obvious that during the degradation of citric acid by *O.oeni,* an equivalent amount of acetic acid is being produced. Metabolites, like acetoin and diacetyl, are responsible for the typical buttery character of MLF. Moreover, diacetyl is not the only by-product that essentially affects the organoleptic quality and in addition other compounds attribute to the typical MLF character.

The widely investigated technique to reduce the intensity of the MLF character is the method of diacetyl management. The drawback of the diacetyl management is the dependency on the presence of active LAB or yeast and low redox-potential, which is mainly present during the alcoholic fermentation. The best method to ensure diacetyl degradation is the simultaneous inoculation of yeast and bacteria. Wines produced by this method show less lactic notes than post fermentation inoculations. However, it is not guaranteed that the degradation will be completed in all fermentations. Additionally, acetic acid and a certain residual profile of the metabolic intermediates remain in the wine.

Fig. 2. Metabolism of citrate



Source: Jan Clair Nielsen 1999

New MLF Starter Cultures

The development of a citric acid negative MLF starter culture gave a new opportunity to avoid diacetyl and acetic acid production from the citric acid degradation. The fermentation with a citric acid negative MLF starter culture will best preserve the varietal character of the wine.

In a comprehensive four year study at the wine research institute DLR-RNH Bad Kreuznach in Rhineland-Palatinate-Germany, different MLF starter strains were tested under practical winemaking conditions. Figure 1. shows the fermentation curves of malic acid by different MLF strains with simultaneous inoculation in the same base wine. A standard MLF strain was compared with two citric acid negative strains of MaloBacti™ CN1. This new generation of improved citric acid negative strains were developed in collaboration with Dr. Jürgen Fröhlich, University of Mainz. The fermentation curves do not show any significant difference in fermentation dynamics. The analytical data in Graphs 2 and 3 show the differences in citric acid and acetic acid levels. The citric acid negative strains do not show any significant increase in volatile acidity (VA) and retain the initial figure of citric acid as well. The standard strain shows typically higher VA and a complete degradation of citric acid.

Conclusions

There are many ways to influence the aroma profile of wine with MLF. Timing of inoculation and ageing on the lees are possible methods to reduce the lactic notes. But these applications depend very much on external factors such as viable yeast, bacteria and redox-potential. The most promising method to avoid safely the impact of lactic notes originating from the citric acid metabolism of *Oenococcus oeni* is the inoculation of a citric acid negative MLF starter strain. Their metabolism does not produce diacetyl, acetic acid or intermediate by-products derived from citric acid.