Necessary Evil: Chemical Deacidification for High Acid Wines

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Acid is an essential part of the wine experience, contributing necessary balance to the mouthfeel. Too much acid is a problem, since it will throw off the balance and make the wine much less enjoyable to drink. Grapes grown in cooler climates face two main challenges when it comes to acid concentration: 1) cooler growing conditions mean that the grapes will metabolize less acid and have a higher titratable acidity (TA) than those same grapes grown in a warmer place, and 2) the cultivars most suited to cold climates (especially the cold climate hybrids) are often inherently high in acid and will have a relatively high TA regardless of the season. If one or both of these factors happens to work against a producer, it will be difficult to create a balanced wine.

As part of the *Northern Grapes Project*, both microbiological and chemical means are being considered to find ways to reduce acid when necessary. The microbiological route, relying on yeast or lactic acid bacteria to consume malic acid, was covered in the January 8, 2013 webinar, "Malolactic Fermentation," by Sigrid Gertsen-Schibbye, while this article will deal with chemical deacidification.

Acid in grapes. Tartaric and malic acid are the two primary acids (hopefully*) present in harvested grapes. Tartaric acid content is generally considered to be fixed, whereas malic acid is consumed as the season progresses and heat units accumulate. Those who measure a change in TA and pH as harvest approaches are most likely measuring the malic acid drop. From a winemaker's perspective, acid plays two major roles: 1) it contributes to mouthfeel, and 2) it keeps the pH low enough to discourage the growth of spoilage microbes. Tartaric acid is considered a "better" acid than malic because tartaric will keep the pH lower at the same g/L; that is, it takes less tartaric to do job #2. Tartaric acid is also easier to remove using the most common deacidification processes.

Wines that have "too much" acid due to season and/or variety almost always have disproportionately large amounts of malic acid. In these cases, a malolactic fermentation (conversion of malic acid to lactic acid by bacteria) will most likely result in an unacceptably high lactic acid content. Therefore, deacidification methods that favor the "direct" removal of malic acid would be beneficial to cold climate producers.

Deacidification. Traditional chemical deacidification involves the removal of tartaric acid simply by chilling the wine, by chilling along with seeding with potassium bitartrate, and/or by adding carbonates (potassium or calcium). There are fewer options for removing malic acid chemically, however, and there is really only one traditionally used technique: the so-called "double-salt" procedure.

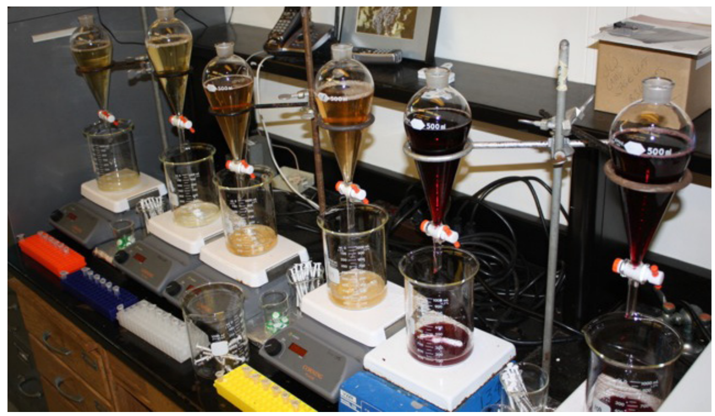


photo: Chris Gerling, Cornell University

A laboratory set-up as shown above is used to compare multiple treatments or multiple wines with one treatment. In this photo, the effectiveness of seed crystals is being evaluated in La Crescent, Frontenac, and Frontenac gris.

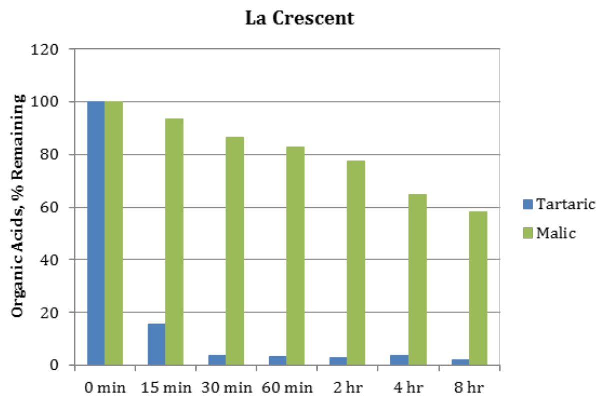
The double-salt procedure is intended to remove both acids simultaneously and quantitatively by forming a calcium malo-tartate double salt. Crystallography has shown that this salt is not actually formed, and time-course work shows that tartaric acid is removed first, followed by a portion of the malic. While this method does remove malic acid, it doesn't appear to be a way to preferentially target it by any means. We plan to continue to look at ways to affect the solubility of malic acid salts so we can more efficiently remove them.

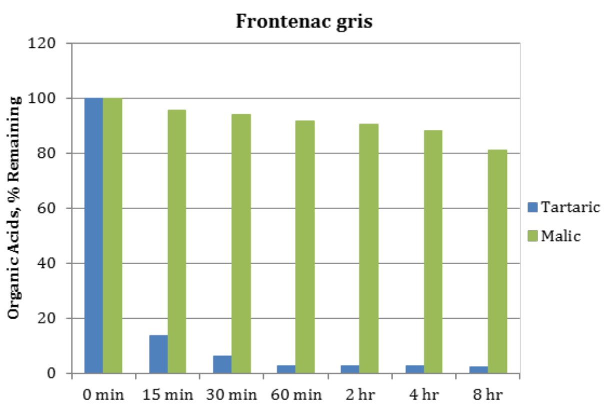
Current research. Our work on the cold-hardy cultivars has so far focused on repeating what we think of as the "traditional" double salt method, i.e. what winemakers are actually able to do in their cellars, and investigating the basic procedures to see how much they affect the process. For example, the method calls for adding the liquid to be deacidified to the carbonate powder (as opposed to vice versa). This order might increase the pH at the beginning, favoring the removal of malic acid. We are also looking at the importance of using seed crystals (calcium malate), which can make reactions happen more quickly and easily by providing a site for the larger crystals to "grow." Potassium bitartrate is used in cold stabilization for just this purpose.

We are also comparing the relative efficacy of the treatment in juice vs. wine. We have found some differences to date, but still nothing that favors the removal of malic acid over tartaric. There are a few reasons for this, but the primary one seems to be solubility. In most every circumstance in which we place the system, tartaric acid is less soluble than malic, meaning it will precipitate more readily. Further work is planned to try and reduce the solubility of malic acid relative to tartaric in a juice/ wine matrix.

For those who struggle with high acidity, there are plenty of winemaking options aside from chemical treatments. Along with the aforementioned malolactic fermentation, which will replace malic acid with the weaker lactic, there are also other approaches. Keeping in mind that acid is part of the wine balance equation, one way to counter higher perceived acidity is to increase other parameters, such as sweetness. The classic way of explaining this idea is lemonade. Adding sugar to lemon juice makes it much more palatable. We haven't actually lowered the acid, however — we've just changed the perception. More sugar, therefore, won't necessarily result in a sweet wine. The name of the game is balance.

** Acetic acid, if present in large quantities, indicates rot/ spoilage problems.*





Results from a "traditional" double-salt procedure in La Crescent (top) and Frontenac gris (bottom). Note that the tartaric acid disappears first, followed by 20-40% of the malic acid.

Credit: David C. Manns, Cornell University.