

The tricks and traps of deacidification

The cooler than usual 2017 vintage resulted in some wines with higher titratable acidity (TA) levels than usual. In some cases, circumstances necessitated deacidification and winemakers contacted the helpdesk requesting advice.

This column focuses on the chemical deacidification of wine using permitted carbonate salts.

WHAT IS CHEMICAL DEACIDIFICATION?

There are various methods that can be used to decrease acidity, including conducting a malolactic fermentation, blending with a less acidic wine and ion exchange.

However, if malolactic fermentation has already been conducted (or cannot be conducted) and blending or ion exchange are unavailable, then chemical deacidification can be used.

This method involves adding a base to neutralise some of the acids in the wine.

WHAT CHEMICAL DEACIDIFICATION AGENTS CAN BE USED?

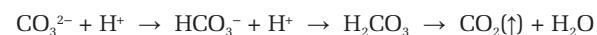
The Australia New Zealand Food Standards Code, Standard 4.5.1 – Wine Production Requirements, indicates that calcium carbonate (CaCO_3), potassium carbonate (K_2CO_3) and potassium bicarbonate (KHCO_3) can be used.



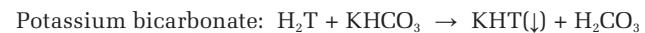
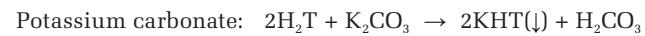
WHAT ARE THE REACTIONS THAT OCCUR?

The carbonate anion (CO_3^{2-}) reacts with acid (H^+) to form the bicarbonate anion (HCO_3^-), which reacts with further acid to form carbonic acid (H_2CO_3).

This then breaks down to carbon dioxide gas and water:

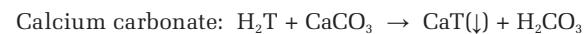


However, given that wine tends to be saturated with potassium bitartrate (KHT) from tartaric acid (H_2T), precipitation of KHT occurs when K_2CO_3 and KHCO_3 are used:



The precipitation of KHT results in the loss of a proton from solution, which leads to further reduction in acidity.

This does not occur with CaCO_3 , as in this case the tartrate anion is involved rather than the bitartrate anion, which does not remove a proton from solution:



The above precipitation reactions only occur with tartaric acid salts, as the potassium and calcium salts of malic acid, for example, are soluble in wine and the precipitation of the so-called 'double salt' (double tartromalate salt) is only possible above pH 4.5 (Ribéreau-Gayon et al. 2006).

WHICH CARBONATE SALT SHOULD I USE?

As indicated above, one of the reactions that occurs with the addition of CaCO_3 is the precipitation of calcium tartrate (CaT). However, CaT crystals are slow to form and usually do not come out of solution for several months, which can often be after bottling.

Deacidification should be treated the same as any other fining or amelioration process. Laboratory trials should be conducted on samples of the juice or wine using a number of different fining rates before proceeding with the entire batch.

Table 1. Addition rate of potassium bicarbonate (KHCO_3) and corresponding pH and TA values for a red wine.

Rate of addition of KHCO_3 (g/L)	pH	Titratable acidity (g/L)
0 (Control)	2.94	10.2
1	3.15	9.4
2	3.29	8.3
3	3.50	7.0
4	3.76	5.7

Consequently, the use of potassium-based carbonates is often preferable. Potassium bicarbonate is recommended over potassium carbonate, as the bicarbonate is a weaker base and is therefore the more ‘gentle’ deacidification agent (Rankine 2007).

Considerable CO_2 can be evolved during the deacidification process, which can cause excessive foaming, and the bicarbonate salt will tend to cause the least foaming of the three deacidification agents.

HOW MUCH WILL THE TA DECREASE?

The change that occurs in TA (and pH) largely depends on the wine’s buffer capacity, which in turn depends on the various acids present and their concentrations.

However, if a wine has a TA in the range 8–10 g/L, then a general rule of thumb is that for each 1.0 g/L decrease in TA, 0.6 g/L of K_2CO_3 or 0.9 g/L of KHCO_3 is required (Mattick 1984). If using CaCO_3 , then 0.67 g/L of the carbonate is required to decrease the TA by 1.0 g/L.

HOW SHOULD I PROCEED IF I'M GOING TO DEACIDIFY?

Deacidification should be treated the same as any other fining or amelioration process. Laboratory trials should be conducted on samples of the juice or wine using a number of different fining rates before proceeding with the entire batch.

The addition rates can be decided by estimating the changes in TA using the values provided above.

The actual effects on pH and TA, as well as the sensory aspects, should be determined for each addition rate. Once consideration has been given to these parameters for each addition rate, the appropriate rate of addition can be chosen.

An example of the effect on pH and TA for various addition rates of KHCO_3 to a red wine is provided in Table 1.

For this wine, the average TA decrease was about 1.1 g/L for each 1 g/L addition of KHCO_3 and the corresponding pH increase was about 0.2 units.

In the cellar, the deacidification should be carried out on reasonably clean juice or wine that has been cooled to below 4°C. The KHCO_3 can be dissolved in water or in some of the wine and added slowly with careful mixing during the addition and for at least 30 minutes afterwards.

The juice/wine should be allowed to settle for several hours at <4°C and then racked/filtered at the same temperature.

For further information on deacidification, contact the AWRI helpdesk on helpdesk@awri.com.au or 08 8313 6600.

References

- Food Standards Australia New Zealand, Food Standards Code, Chapter 4: Primary production standards (Australia only). Part 4.5: Wine production requirements. <http://www.foodstandards.gov.au/code/>
- Mattick, L.R. 1984. Acidity and pH control. Practical Winery. 5(4): 30–38.
- Rankine, B. 2004. Making good wine. Sydney: Pan Macmillan Australia Pty Ltd: 120.
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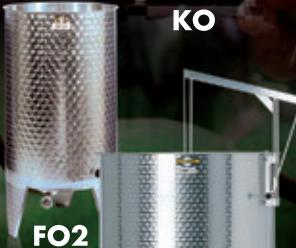
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