

DMDC – an insurance policy

Dimethyl dicarbonate (DMDC) is a chemical antimicrobial additive that can be used in addition to sulfur dioxide when there is increased risk of microbiological growth in wine. Its main use has been as an insurance policy when bottling wines with residual sugar or as a control against *Brettanomyces* or other viable microorganisms when adequate levels of sulfur dioxide or filtration are not achievable. In this column, Adrian Coulter answers some of the questions that arise when winemakers consider using DMDC at bottling.

How does DMDC work?

DMDC works by reacting with amino acid residues within two main cellular enzymes of a microorganism: alcohol dehydrogenase and glyceraldehyde-3-phosphate dehydrogenase (Porter and Ough 1982). With these enzymes deactivated, glycolysis, which is required for energy production, cannot continue, so the cell dies.

Is it true that DMDC increases the methanol concentration of wine?

DMDC hydrolyses to methanol and carbon dioxide in wine, so yes, the addition of DMDC can increase the

concentration of methanol. The reaction of DMDC with water is given by the following equation:



Calculations using the molecular weights of DMDC and methanol reveal that the theoretical maximum amount of methanol that could be formed from adding the maximum allowable amount of DMDC (200 mg/L) is 96 mg/L. Stafford and Ough (1976) conducted reactions in model solutions and confirmed this figure. However, DMDC will react with other compounds in wine, such as the amino acid residues in microorganisms

as mentioned above, so it would be expected that less than 96 mg/L of methanol would be formed.

What is the usual amount of methanol present in wine?

Wines naturally contain some methanol due to the hydrolysis of methylated pectin, which is formed in grapes by endogenous pectin methylesterase (PME). Pectinases added to juice can also increase the level of methanol in wine. Hodson et al. (2017) surveyed 60 white and 90 red Australian wines, from multiple varieties and vintages, and found the mean concentrations of methanol to be 58 mg/L and 170 mg/L,

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respectively. For the white wines the methanol concentration ranged from 40 to 120 mg/L, while for the red wines the methanol concentration ranged from 60 to 280 mg/L. Wines produced from grapes affected by *Botrytis cinerea* can have higher concentrations (up to 364 mg/L) due to PME produced by this invasive organism.

What are the legal limits for methanol in wine?

The Australia New Zealand Food Standards Code (Standard 1.4.1) prescribes limits for methanol in Schedule 19 (Maximum levels of contaminants and natural toxicants), summarised in the table below.

Table 1.

Product	Maximum level of methanol
Red wine, white wine and fortified wine	3 g of methanol per litre of ethanol
Whisky, rum, gin and vodka	0.4 g of methanol per litre of ethanol
Other spirits, fruit wine, vegetable wine and mead	8 g of methanol per litre of ethanol

Given the maximum permitted levels of methanol are specified in terms of the ethanol level, the maximum permitted methanol level in any particular wine will depend on its alcoholic strength. For example, the maximum permitted concentrations of methanol for wines containing 8% v/v and 14% v/v ethanol are 240 mg/L and 420 mg/L, respectively. For a typical table wine it is highly unlikely that a DMDC addition will lead to the wine exceeding legal methanol limits.

How much DMDC should I add?

Several studies have investigated the level of DMDC required to inhibit the growth of various oenological microorganisms


in wine and model media. However, the efficiency of DMDC depends on many factors, including the type and species of microorganism, the number of cells/mL present in the wine, temperature, pH and ethanol content, so the chosen addition rate should take into consideration these parameters. DMDC product suppliers indicate that the usual dosage for wine is between 125 mg/L and 200 mg/L (Anon. 2020), where 200 mg/L is the maximum permitted addition.

What's the best way to add DMDC?

To be most effective at bottling, DMDC should be added just prior to the filler bowl. However, there are some safety concerns regarding the handling of undiluted DMDC, as it is dangerous if inhaled or allowed to contact the skin. In addition, due to its reactivity and rapid hydrolysis, it must be adequately homogenised through the wine. Because of these safety and technical issues, a metered dosing apparatus is required, which is best left to bottling facilities that are specifically set up for adding DMDC.

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

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