Removal of sulfur dioxide from must, juice and wine

1. Removal of SO_2 from wine

A. Hydrogen peroxide

The removal of sulfur dioxide from wine using hydrogen peroxide (H_2O_2) is an effective, and if performed carefully, safe procedure. The H_2O_2 reacts with the free SO_2 in the wine which is oxidized to sulfate. After such removal, further free SO_2 may be generated from the remaining bound fraction.

The H_2O_2 should be added in a dilute form (recommend less than 1% w/v), slowly, with adequate mixing (e.g. tank recirculation) to avoid localised oxidation. The wine should then be allowed to equilibrate for at least several hours before confirmatory analysis of the concentration of remaining free and bound sulfur dioxide in the wine is done to confirm the success of the addition.

The Australian Food Standards Code (here) part P4 lists H_2O_2 amongst several legal additives. It sets a maximum concentration of H_2O_2 permitted in wine of 5 mg/L, and a maximum concentration of soluble sulfates, (expressed as potassium sulphate) at 20ºC of 2 g/L. The maximum concentration of total sulfur dioxide is, at the time of preparation of this document, 300 mg/L ("for wines containing greater than 35 g/L of sugars"; the limit is 250 mg/L for wines with less than this concentration of sugars); this is, along with all aspects of the Standard, subject to review from time to time. The legality of H_2O_2 use varies from country to country; and at the time of preparation of this document, it is not a permitted additive in the European Union, for example.

The following guidelines detail how to calculate the quantity of H_2O_2 to add in order to remove a given concentration of SO_2. Winemakers should be aware of the potential risks of a loss of wine quality associated with hydrogen peroxide additions if care is not exercised. H_2O_2 is a strong, non-specific oxidising agent, and under the conditions of use in wine it may have a limited effect on various other wine components.

1. Calculate the concentration of free SO_2 to be removed.

2. Calculate corresponding amount of SO_2 in grams.

   This can be done by multiplying the concentration of free SO_2 to be removed by the volume of wine (L) in question. It is advisable at this stage to divide the result by 1000 to express the answer in terms of grams (rather than milligrams).

3. Calculate corresponding amount of H_2O_2 in grams.

   Molecular weight of SO_2 = 64 g/mol
   Molecular weight of H_2O_2 = 34 g/mol
   Therefore, corresponding amount of H_2O_2 = 34/64

4. Express amount of H_2O_2 calculated as a measurable volume in mL.

   The amount of H_2O_2 calculated above must be expressed in terms of volume, according to the strength of the solution used. Commercial H_2O_2 is typically 30–35% w/v (i.e. 35 g/100mL).

5. Caution

   Never decrease the calculated free SO_2 to less than 10 mg/L

   It is preferable to carry out a number of staged incremental additions as opposed to one single large addition.

   The first addition should be approximately 50% of the calculated amount.

   Dilute a known amount of hydrogen peroxide down to 3% and drip into tank which is being rummaged vigorously under inert gas.

After each addition re-analyse the free SO_2 and re-calculate the amount of hydrogen peroxide to add. Wear appropriate personal protection equipment where appropriate.

SO_2 will re-equilibrate in solution after a fairly short time. Re-analyse after at least 30 minutes. It is quite common to have to add H_2O_2 in several stages in order to achieve the final SO_2 concentration desired.

6. Numerical example: *Removal of 25 mg/L SO_2 from 1700 L wine.*

Calculate the amount of SO_2 to be removed:	25 mg x 90% x 1700 L = 38250 mg (= 38.3 g)
Calculate corresponding amount of H_2O_2:	38.3 g x 34/64 = 20.32 g
Express amount of H_2O_2 as a volume:	Assume 35% w/v (i.e. 35 g/100 mL) H_2O_2 used = 20.32 g x 100 mL/35 g = 58 mL

B. Yeast addition

If you wish to reduce the SO_2 in juice prior to inoculation, the use of a 'sacrificial'yeast cell culture has been found to be quite successful. Generally an inoculum at twice the normal rate has been used. Please contact the Winemaking Services group for further information (winemakingservices@awri.com.au).

2. The addition of sulfur dioxide:

The addition of sulfur dioxide may be made using 'pure' sulfur dioxide (available as a pressurised liquid), as an aqueous solution which may be prepared by bubbling gaseous SO_2 into water, or as solid potassium metabisulfite ($K_2S_2O_5$, often abbreviated colloquially to *PMS*) , which may be dissolved in water or wine before addition.

The following link to the AWRI calculators will assist you with any SO_2 additions (http://www.awri.com.au/practical_solutions/calculators/).

The proportion of SO_2 in PMS is approximately 57 % w/w. N