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Sulphur dioxide additions

Calculations

The following is a guideline for sulphur dioxide additions during winemaking.
Online calculators are also available on our website by logging in at the client portal.

Sulphur dioxide (SO_2) may be added in one of the following forms:

- A potassium (or sodium) metabisulfite salt
- A sulphur dioxide solution (prepared using potassium or sodium metabisulfite)
- A liquid 'gas' kept under pressure in a sulphitometer

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1. Metabisulfite Addition (powder form)

The potassium metabisulfite ($K_2S_2O_5$) is a white crystalline salt, which contains 57.6 % sulphur dioxide (SO_2). By using the following equation, you can determine the amount (weight) of potassium metabisulfite to add to the juice/wine depending on the specific needs. Potassium metabisulfite is dissolved in warm water before being used.

⇒ Please note in the following equations: **SO_2 addition (mg/L) = Target SO_2 (mg/L) – Current SO_2 (mg/L)**

Adjusting Free SO_2

$$\text{Potassium Metabisulfite } (K_2S_2O_5)\ (g) = \frac{\text{volume (L) x free } SO_2 \text{ addition (mg/L)}}{0.576} \div 1000$$

Not all the added SO_2 is converted to free SO_2. A certain percentage of the added SO_2 will bind with wine constituents (such as acetaldehyde, sugars, phenolic compounds, anthocyanins and other). In general, a binding percentage of **30% (factor 1.3)** can be assumed for subsequent additions, however, this percentage can be adjusted as deemed fit (in cases of unhealthy grapes or oxidation). A higher percentage **(up to 120%; factor 2.2)** can be applied for first time additions (at crushing). Table 1 can be used to determine the factor.

$$\text{Potassium Metabisulfite } (K_2S_2O_5)\ (g) = \frac{\text{volume (L) x free } SO_2 \text{ addition (mg/L)}}{0.576} \times \text{factor} \div 1000$$

Example:
Target SO_2 = 45
Current SO_2 = 10
Binding factor = 1.3 (30%)
Volume = 1500 L

$$\text{Potassium Metabisulfite } (K_2S_2O_5)\ (g) = \frac{1500 \times 35}{0.576} \times 1.3 \div 1000$$

$$= 182 \text{ g}$$

Adjusting Total SO_2

For total SO_2 adjustments, the binding % is not applicable:

$$\text{Potassium Metabisulfite } (K_2S_2O_5)\ (g) = \frac{\text{volume (L) x total } SO_2 \text{ addition (mg/L)}}{0.576} \div 1000$$

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2. Sulphur Dioxide Solution Addition (liquid form)

A convenient method of adding SO_2 to must and wine is to use a solution of known concentration. In cellars, SO_2 solution is usually purchased in concentrations of 5%, 10 % or 18%. Solutions can also be made by dissolving the metabisulfite in water.

⇒ Please note in the following equations: **SO_2 addition (mg/L) = Target SO_2 (mg/L) – Current SO_2 (mg/L)**

Adjusting Free SO_2

$$\text{Amount of 18 \% } SO_2 \text{ solution (mL)} = \frac{\text{Volume (L)} \times SO_2 \text{ addition(mg/L)}}{18} \div 10$$

The percentage of SO_2 solution used can be adjusted in the equation by replacing '18' with the relevant concentration.

Not all the added SO_2 is converted to free SO_2. A certain percentage of the added SO_2 will bind with wine constituents (such as acetaldehyde, sugars, phenolic compounds, anthocyanins and other). In general, a binding percentage of **30% (factor 1.3)** can be assumed for subsequent additions, however, this percentage can be adjusted as deemed fit (in cases of unhealthy grapes or oxidation). A higher percentage **(up to 120%; factor 2.2)** can be applied for first time additions (at crushing). Table 1 can be used to determine the factor.

$$\text{Amount of 18 \% } SO_2 \text{ solution (mL)} = \frac{\text{Volume (L)} \times SO_2 \text{ addition (mg/L)}}{18} \times \text{factor} \div 10$$

Example:
Target SO_2 = 40
Current SO_2 = 15
Binding factor = 2.2 (120%)
Volume = 1450 L

$$\text{Amount of 18 \% } SO_2 \text{ solution (mL)} = \frac{1450 \times 25}{18} \times 2.2 \div 10$$

$$= 443 \text{ mL}$$

Adjusting Total SO_2

For total SO_2 adjustments, the binding % is not applicable:

$$\text{Amount of 18 \% } SO_2 \text{ solution (mL)} = \frac{\text{Volume (L)} \times SO_2 \text{ addition (mg/L)}}{18} \div 10$$

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3. Liquid 'gas' Addition (gas form)

The purest form of SO_2 is available as a compressed gas. The gas is very volatile and is harmful to breathe so it is not convenient to work with. Therefore, other forms of SO_2 are usually used in wineries.

A few considerations

- After SO_2 additions, the wine should be mixed thoroughly before taking a sample for analysis. If not mixed properly, results can be inaccurate and non-representative.
- It is important to test final SO_2 concentration after adjustments has been made to ensure sufficient antimicrobial and antioxidant protection.
- If the desired free SO_2 concentration is not reached after addition, one or more of the following explanations could apply:
  1) The binding percentage is higher
  2) The sulfite salt is not fresh
     - Contact with carbon dioxide and moisture in the air causes the salt to degrade
     - Keep your container of potassium metabisulphite tightly closed to minimize degradation
     - Purchase fresh salt yearly
  3) The must/wine was not sufficiently mixed after addition

Table 1 shows the conversion from estimated percentage (%) of free SO_2 that will go into the bound form and the factor that is used in the calculation.

Estimated percentage (%) of free SO_2 that will go into the bound form	Factor used in equation
10	1.1
20	1.2
30	1.3
40	1.4
50	1.5
60	1.6
70	1.7
80	1.8
90	1.9
100	2.0
110	2.1
120	2.2
130	2.3
140	2.4
150	2.5

Table 1. The conversion from estimated binding % and factor used in calculation

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The effect of pH and the amount of molecular SO_2 needed were not discussed in this paper and should be kept in consideration when determining SO_2 additions. Further information can be obtained from the *Vinlab manual* on pages 20 and 52. For convenience, the amount of SO_2 needed at different pH levels are shown in Table 2.

pH	% molecular SO_2	Free SO_2 (mg/L) required for 0.6mg/L molecular SO_2	Free SO_2 (mg/L) required for 0.8mg/L molecular SO_2
2.90	7.5	8	11
2.95	6.6	9	12
3.00	6.1	10	13
3.05	5.3	11	15
3.10	4.9	12	16
3.15	4.3	14	19
3.20	3.9	15	21
3.25	3.4	18	23
3.30	3.1	19	26
3.35	2.7	22	29
3.40	2.5	24	32
3.45	2.2	27	37
3.50	2.0	30	40
3.55	1.8	33	46
3.60	1.6	38	50
3.65	1.4	43	57
3.70	1.3	46	63
3.75	1.1	55	72
3.80	1.0	60	79
3.85	0.9	67	91
3.90	0.8	75	99
3.95	0.7	86	114
4.00	0.6	100	125

Table 2. pH/molecular SO_2 table

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