

Molecular SO₂

Molecular SO₂ now reported when Free SO₂ and pH are both analyzed

Sulfur dioxide exists in three forms when dissolved in water: bisulfite (HSO₃⁻), sulfite (SO₃²⁻), and molecular sulfur dioxide (SO₂). The most prevalent forms in wine are bisulfite and molecular sulfur dioxide. The equilibrium between these two forms of sulfur dioxide in wine is influenced by pH, temperature, ethanol concentration, and ionic force, with pH having the greatest influence.

Since most of the anti-microbial properties associated with sulfur dioxide are attributed to the molecular form, the concentration of molecular sulfur dioxide is of great importance to the winemaker. A good estimate of the level of molecular sulfur dioxide in wine can be made using the free sulfur dioxide and pH values.

A molecular SO₂ level of 0.8 mg/L has been suggested by various authors^{1,2,3} as the effective level for inhibition of wine spoilage bacteria and yeast.

This level of molecular SO₂ does not necessarily kill the spoilage organisms, but helps prevent further growth or replication of them in wine. It is the combined interaction of pH, alcohol, molecular SO₂ and temperature on the spoilage organisms, along with the individual stress tolerance of that particular organism, which determines if the organism will multiply, remain static, or die.

Increasing the levels of molecular SO₂ can induce a viable but non-culturable state in many wine spoilage organisms. As the molecular SO₂ decreases these organisms are able to resume growth.

The most effective use of SO₂ to control microbial

- ¹ Beech R.W., Burroughs, L.F., Timberlake, C.F., Whiting, G.C. 1979. *Progres recents sur l'aspect chimique et l'actopm anto-microbienne de l'anhydride sulfureux. Bulletin O.I.V. 586 :1001-1022*
- ² Henick-Kling, T., C. Egli, J. Licker, C. Mitrakul, T.E. Acree. 2000. *Brettanomyces in Wine. Proceedings of the 5th International Symposium on Cool Climate Viticulture and Oenology, 16-20 January 2000, Melbourne, Australia.*
- ³ Chatonnet, P., J. N. Boidron, and D. Dubourdieu. 1993. *Influence des conditions d'elevage et de sulfitage des vins rouges en barriques sur leur teneur en acide acétique et en ethyl-phenols. J. Int. Sci. Vigne Vin. 27:277-298*

growth in wine is achieved by maintaining as high a molecular SO₂ as possible without causing negative sensory impact.

It is often difficult or impossible to maintain levels of molecular SO₂ in high pH wines that are sufficient to prevent microbial growth without negatively impacting the wine. A wine with a pH of 3.5 requires 40 mg/L free SO₂ to achieve a molecular SO₂ of 0.8 mg/L, whereas wine with a pH of 3.9 would require free SO₂ levels of approximately 99 mg/L.

In certain types or styles of wine where it is not practical to achieve the necessary level of molecular SO₂ for protection, other methods of monitoring microbial populations and activity such as the ETS Scorpions spoilage panel and 4EP/4EG analysis can be used to augment a winery QC program.

Wine pH	Free SO ₂ Equivalent for 0.8 mg/L Molecular SO ₂
2.90	11 mg/L
3.00	13 mg/L
3.10	16 mg/L
3.20	21 mg/L
3.30	26 mg/L
3.40	32 mg/L
3.50	40 mg/L
3.60	50 mg/L
3.70	63 mg/L
3.80	79 mg/L
3.90	99 mg/L
4.00	125 mg/L

This document is a compilation of information and views from various sources provided for the convenience of our clients. Information provided in this document is provided "as is" without warranty of any kind, either expressed or implied, including but not limited to the warranties of merchantability, fitness for a particular purpose and freedom from infringement. User assumes the entire risk as to the accuracy and the use of this document. This document may be copied and distributed subject to the following conditions: 1) All text must be copied without modification and all pages must be included 2) All copies must contain ETS' copyright notice and any other notices provided therein 3) This document may not be distributed for profit. All trademarks are acknowledged. Copyright © ETS Laboratories 2001-2008.