PRODUCTION GUIDE

ADJUSTING & TROUBLESHOOTING FREE SO_2 PRIOR TO BOTTLING

SULFUR DIOXIDE (SO_2) PROBLEMS IN WINE

The application and addition of sulfur dioxide is challenging. If you make a mistake in an addition somewhere during your winemaking career, know you are not alone.

This Production Guide provides details regarding free sulfur dioxide (SO_2) levels during immediate, pre-bottling stages. Specifically, it looks at pre-filtration (prior to plate-and-frame, lenticular, or crossflow filtration), in between rough/fine filtration and sterile filtration, and prior to bottling.

For some wines, a high free SO_2 concentration may be experienced. At certain stages of production, having an elevated free SO_2 is not necessarily a bad thing. For wineries that cannot eliminate headspace in tanks or use tanks that can integrate a fair amount of oxygen over time (*e.g.*, variable capacity tanks or plastic tanks/totes), elevating the free SO_2 above the 0.85 mg/L (molecular) target for that white or rosé wine may be a winemaking strategy to minimize microbial growth. (For red wines that do not have a high pH, the molecular target is usually 0.50 mg/L even though this is not an antimicrobial concentration. Refer to "**Demystifying Sulfur Dioxide**" and "**Sulfur Dioxide Strategies for Juice and Wine**" for more information on sulfur dioxide chemistry and use in wine.)

But sometimes, the free SO_2 can be elevated above manageable concentrations, especially as the wine gets closer to bottling time. Dealing with a high free SO_2 is difficult, and it will require some time to address. If in a bottling timeline crunch, do not expect to turn these wines around within a day or two. Depending on the free SO_2 concentration in relation to the pH (the molecular concentration), it is possible that the wine may need several days to weeks of re-work. Spend the time to go through re-work in order to rescue the wine's quality and maintain the brand identity. Once the wine is bottled, it is not possible to address a high free SO_2.

Note: Several winemakers have inquired about hydrogen peroxide additions to address high free SO_2 concentrations. The addition of hydrogen peroxide to wine is **not** legal in the United States.

GENERAL PRODUCTION CONSIDERATIONS WHEN BLENDING

Blending is a valuable tool when working with high free SO_2 wines. In many cases, a high free SO_2 wine can get blended with a low free SO_2 wine. Though, blending and analytical evaluation needs integrated to confirm both the free and total SO_2 are within legal limits.

The pH of the two wines will also contribute to the efficacy of this practice. For example, using a higher pH, low free SO_2 wine to blend with a wine that has a high free SO_2 can be beneficial by providing an increase in pH to the blended, base wine. The higher pH alters the equilibrium of free SO_2 in the molecular form.

Depending on the wine production stage, it is possible the winemaker may need to go back and re-work various stabilization processes after blending wines. Whites, rosés, and blush wines will need to get analyzed for cold and protein stability. These blended wines may require additional bentonite additions even if the base wines had previously been protein stabilized. Please refer to "**Successful Wine Protein Stabilization**" for more information on ideal protein stability practices.

PRODUCTION STEP	SO_2 EXPECTATION / APPLICATION	EXPLANATION
Pre-Filtration (*e.g.*, plate-and-frame, crossflow, lenticular)	**Whites/Rosés:** Free SO_2 concentration can be up to about 20 mg/L above the 0.85 mg/L (molecular) concentration. If it is this high, avoid inert gas flushing prior to filtration. **Reds:** Free SO_2 concentration can be about 20 mg/L above the 0.5 mg/L above the 0.50 mg/L (molecular) concentration. If it is this high, avoid inert gas flushing prior to filtration. **High pH (>3.60) Wines:** Apparent free SO_2 concentration should be >20 mg/L or the total SO_2 concentration should be >150 mg/L.[1]	Using an inert gas flush, specifically the use of argon, will inhibit free SO_2 from blowing off during transfer. This practice will keep the free SO_2 concentration more stable through the production step. If you do not have access to argon, having an elevated free SO_2 concentration will help retain the level that is adequate for antimicrobial protection. Some will get lost during transfer (*i.e.*, filtration) due to the integration of oxygen.
If the Free SO_2 Concentration is Too High Prior to Filtration	Address the free SO_2 concentration prior to filtration. Some options include: 1. Move the wine to help aerate. Do not use inert gas to do this. 2. Blending with a higher pH and lower free SO_2 wine in the winery. 3. Purchasing bulk wine with a higher pH and lower free/total SO_2 concentration to blend.	If blending, you should create a bench sample first and get analysis on the blend to confirm the blend has addressed the problem. At minimum, measure pH, free SO_2, and total SO_2 concentrations. If the analysis of the sample blend comes back adequate, move onto blending the batches of wine. Note that these wines may require additional analysis and stabilization to proceed. Refer to the **Pre-Bottling Prep Timelines** for production order.
Post-Filtration and Prior to Sterile Filtration	Confirm the free and total SO_2 concentration prior to bottling. **Whites/Rosés:** Free SO_2 concentration can be 10 – 12 mg/L above the 0.85 mg/L (molecular) target if no inert gas flushing is used during bottling. Concentration can be closer to target 0.85 mg/L (molecular) target if argon flushing is used or if there is a record of free SO_2 loss for the winery. **Reds:** Free SO_2 concentration can be 10 – 12 mg/L above the 0.50 mg/L (molecular) target if no inert gas flushing is used during bottling.	Using an inert gas flush, specifically the use of argon, will inhibit free SO_2 from blowing off during transfer. This will keep the free SO_2 concentration more stable through the production step. If you do not have access to argon, then having an elevated free SO_2 concentration will help retain the level that is adequate for antimicrobial protection. Some will get lost during transfer due to the integration of oxygen. It is recommended that a winery determine their average free SO_2 loss

	Concentration can be closer to target 0.50 mg/L (molecular) target if argon flushing is used or if there is a record of free SO_2 loss for the winery. **High pH (>3.60) Wines:** It is likely these wines will not experience a high free SO_2. Contact consultant for more assistance.	during bottling so that pre-bottling levels can be specific to their operation.
Prior to Sterile Filtration Adjustments	**Whites/Rosés:** Do not over adjust SO_2 at this stage. Make adjustments 24 – 48 hours prior to bottling. **Reds:** Make adjustments 24 – 48 hours prior to bottling.	If close to the 0.85 mg/L (molecular) target, remember that any addition above that value goes 100% to the free SO_2 concentration. Therefore, adjustments should be small and confirmed by analysis.
If the Free SO_2 Concentration is High After Rough/Fine Filtration and Prior to Sterile Filtration	To try and deplete the free SO_2 concentration: • Re-filter the wine. • 24 hours after filtration, analyze the free SO_2 concentration. • The wine may need to get reworked if the free SO_2 concentration is too high. Refer to the second row of this **Production Guide**.	At this stage, there is only so much a winemaker can do to deplete the free SO_2 concentration. Keep in mind the wine may need to go back a few production steps in order to bottle a wine without a very high free SO_2.

REFERENCES

[1]The Australian Wine Research Institute (AWRI). Revisiting Sulfur Dioxide Use. 2021. Available at: https://www.awri.com.au/industry_support/winemaking_resources/fining-stabilities/microbiological/avoidance/sulfur_dioxide/