

SULFITE, GRAPES and WINEMAKING

Sulfur has been burned in wine containers to purify them since the days of the Roman Empire, and probably much earlier. The ancients may not have known about the world of microorganisms, but they recognized that sulfur helped make their wines last longer. We now know that sulfur dioxide gas (SO_2) released by burning sulfur was the effective agent for retarding spoilage, and we have a more precise way of adding it these days. We make up solutions of sulfurous acid/water to known parts per million of SO_2 . These solutions are stored and added in tablespoons or milliliters to the volume of wine.

After more than 35 years of teaching home winemakers the importance of adding sulfite to wine and monitoring the results with various testing methods, we are concerned that people are still not testing or scheduling SO_2 additions often enough.

While we have seen improvement during these years, many wine samples are still reported with only a few parts per million of SO_2 . These wines may not even yet show the effects of oxidation, but given enough time in this unprotected state, the fruitiness will fade, browning will occur and the taste will become pruney and harsh. To avoid this you need to understand the basics of why sulfite works so well to protect your wine.

When you add sulfite to wine, sulfur dioxide ionizes to the sulfite ion, SO_3^- , and bisulfite ion, HSO_3^- . A small fraction remains in the “molecular” form, SO_2 . It is this molecular form that protects the wine from spoilage organisms and oxidation. As sulfite reacts with other wine components, it becomes “bound” to them and is no longer available to participate in producing “molecular” sulfite.

We cannot measure molecular sulfite directly. Rather, we measure “free” sulfite, and use a table of wine pH values to predict the amount of ‘molecular’ sulfite we will achieve.

This is why it is so important to frequently measure your free sulfite. No matter how high your total sulfite (within reason), it is only the free sulfite number that really counts. Don’t just guess and toss some sulfite in. Analyze it first, then add it. To this end, we offer some advice on ways to keep up with testing your SO_2 .

Methods for Testing Free SO_2

Aeration-Oxidation(AO) Method for Free SO_2

This is the original primary laboratory method for sulfite measurement in wine that helps define what “free” SO_2 means. In the AO method, a wine sample is placed in a flask and phosphoric acid is added to force the sulfite ion into molecular SO_2 . A small air pump pushes air bubbles through the sample. Since sulfur dioxide is a gas, it dissolves in the air stream and transfers to a trapping solution. In the trapping solution, hydrogen peroxide oxidizes the sulfur dioxide into sulfuric acid. Also in the trapping solution is an acid-base indicator that changes color as the sample gas accumulates. After the 10 or 15 minute transfer period, the trapping solution is titrated with sodium hydroxide solution to measure the acid formed. The free sulfite level can be calculated from the titration results.

The Beverage People supplies reagents to hobbyists who have Aeration-Oxidation test apparatus. Please note that while we can sell you a 250 ml bottle of 25% phosphoric acid for use in your home apparatus, we cannot ship it. If you are outside the area, look into sourcing this reagent locally.

Ripper Method for Free SO_2

We sell the 10 pack box of Titrets, based on the Ripper method, but they are only recommended for white wine. The Ripper method is an iodine titration that is often faster, easier, and cheaper than A/O. It is limited by the chemistry involved. Any substance that reacts with iodine—including some tannins—will be measured as sulfite. Further, the acidification of the sample for the titration tends to release some sulfite bound to anthocyanins (color compounds) in red wine, making it appear “free” when it is not.

These Ripper limitations have been largely overcome through a combination of equipment and techniques from Vinmetrica. That company produces proprietary instruments for sulfite analysis (SC-100A, TE162, p. 16) and for sulfite plus titratable acidity (SC-300, see p. 16) that rely on amperometric titration with iodine instead of a visual endpoint or a straight oxidation-reduction (redox) detection. Allowing very rapid titration to overcome release of additional sulfites and showing a very sharp endpoint on the meter to improve precision, they have reduced the discrepancy between AO and Vinmetrica Ripper to only 2 to 3 mg/L (ppm) for most wine samples. Those differences are small enough that the convenience and ease of use will make the Vinmetrica meters attractive choices for many users.

Laboratory Testing

If you would rather not do sulfite analysis yourself but you want to do a good job keeping up with your levels, a wine testing laboratory can do it for you. Find a commercial lab or perhaps a university

lab near you to minimize shipping of samples. For those of you who live in Northern California Wine Country, we can make it very easy for you. Come by the store and pick up a free sample vial (or use your own screw cap container of 60 ml or more) and fill it all the way up with wine. You don’t want to lose sulfur dioxide gas into the headspace of a partially-filled container. Bring your vial back full and pay for the free SO_2 test here at the store. Our lab services partner, Signature Wine Laboratory of Santa Rosa, will pick up the sample and will test it using approved techniques. We also partner with Gusmer Enterprises, Inc. of Windsor, which offers two testing panels for home winemakers on their FOSS WineScan, If you authorize them to (which we recommend) they will email us a copy of your report when they email it to you as well. Give us a call if you would like to discuss your results!

Scheduling SO_2 Additions

Initial sulfite may be added at 50-65 ppm to grapes or juice that is free of rot or mold. The presence of a lot of mold, or grapes in otherwise bad condition, might require twice that amount. Under average conditions the information that follows should keep about 20 to 30 ppm of free SO_2 available throughout the wine’s cycle of production through bottling. If you plan to use ML bacteria, pre-ML sulfite additions should be kept below 50 ppm.

After ML fermentation is complete add 30 ppm, and five days later add 30 ppm again, and AGAIN one week later. Now get the wine tested for free SO_2 . The test results may surprise you, as the SO_2 you have added may have been dissipating at a rapid rate initially.

Above pH 3.5, you will notice that the amounts of free sulfur dioxide required become quite high. It is best to lower the pH by adding tartaric acid early in the fermentation cycle.

Continue testing every 6-8 weeks, adding SO_2 as required to keep at least 20-30 ppm. available in the wine.

Sources of SO_2

SO_2 is available as Campden tablets, effervescent Inodose metabisulfite tablets and as powdered potassium metabisulfite. A premeasured Campden tablet equals 65 ppm in one gallon (13 ppm in a five gallon jug) and is very convenient for those making small amounts of wine. Crush the tablet to a powder to add it.

The 2 gram Inodose tablets add 528 ppm per gallon or 9 ppm per 60 gallons. The 5 gram Inodose tablets add 1320 ppm per gallon or 22 ppm per 60 gallons. The tablets can be dissolved in water to accurately dose carboys. Metabisulfite powder is added in a liquid preparation to adequately disperse it, and because it is very potent. This is also the least expensive method and accurate to measure for any size container.

pH and SO_2

It is generally recognized that only a small amount of molecular SO_2 (.5 to .8 ppm.) needs to be present to provide bacterial sta-

bility in wine, but pH has an important effect on how much free SO₂ is needed in order to provide that amount, and this is why both pH and SO₂ need to be tested.

REGARD THE TABLE OF MOLECULAR SO₂ BELOW. The amount of free SO₂ needed is based on the pH of the wine. A fairly safe amount for protection of the wine is either .5 ppm for red wines or .8 ppm for white wines. If you know the pH, simply make sure you have the corresponding level of free SO₂, or slightly more, present in the wine during storage and bottling.

SIMPLIFIED SULFITE ADDITIONS

Using Sodium or Potassium Metabisulfite Powder

Prepare a 10% Solution

Dissolve 100 g metabisulfite into 1 L distilled water. Stopper and use in 3 months or replace.

Measure by weight or use a 4 oz package minus 1 level teaspoon.



For 5 gallons add 10 ml
Use a 10 ml graduated syringe

**For 30 gallons
add 60 ml**

**For 60 gallons
add 120 ml**

Use a 100 ml graduated cylinder



Molecular SO₂ needed for Stability

pH	.8 ppm. White Wine	.5 ppm Red Wine
2.9	11 ppm.	7 ppm
3.0	13	8
3.1	16	10
3.2	21	13
3.3	26	16
3.4	32	20
3.5	40	25
3.6	50	31
3.7	63	39
3.8	79	49

Preparing Metabisulfite Solutions

10% Solution

Using a gram scale, weigh out 100 grams of potassium metabisulfite and dissolve in 1 Liter of water. Tightly stopper and store labeled: poison. When adding your sulfite additions make sure you measure carefully.

Replace your solution every 3 months.

10% Solution of Metabisulfite

(Add ppm SO₂ to desired amount.)

Must/Wine (gallons)	10	20	25	30	40	50	75
	(Add milliliters of 10% solution)						
1	.6	1.3	1.6	2.0	2.6	3.3	4.9
5	3.3	6.6	8.2	9.9	13.1	16.4	24.6
10	6.6	13.1	16.4	19.7	26.3	32.9	49.3
25	16.4	32.9	41.1	49.3	65.7	82.1	123.2
60	39.5	78.8	98.5	118.3	157.7	187.2	295.7

3% Solution

Dissolve four ounces of potassium metabisulfite powder, in one gallon of distilled water. This is a weaker solution than the 10% solution given above. However, at this concentration, the solution is still quite strong and should be labeled: poison.

Replace your solution every 3 months.

3% Solution of Metabisulfite

(Add ppm of SO₂ to desired amount.)

Must/Wine (gallons)	10	21	33	43	65
	(Add tablespoons of 3% solution)				
1	.15	.32	.50	.66	1.00
5	.75	1.60	2.50	3.30	5.00
10	1.50	3.20	5.00	6.60	10.00

Removing Excess SO₂

If you ever need to lower your SO₂ due to a mistake in calculation try splash racking or stirring vigorously to aerate. If the free SO₂ is still too high do the following: for every 10 ppm free SO₂ you want to remove, add 1 ml. of 3% hydrogen peroxide per gallon of wine. An oxidative reaction occurs immediately. Use only fresh 3% Hydrogen Peroxide, available at the drugstore. Use this method to remove up to 100 ppm - any more than this and the wine will oxidize and lose its flavor.

Please Note: Avoid confusing the above two solution strengths. If you have a scale that weighs in grams, and have access to a pH meter, you should use the 10% solution instructions. Have on hand Pipets or Syringes graduated in .1 ml to .5 ml, 1 ml to 10 ml volumes and a Graduated Cylinder, with a volume of 100 ml, for large additions. Otherwise, use the weaker 3% solution, with household measuring spoons.