Gusmer Enterprises, Inc.®

Sulfide Dectection Kit Instructions

The Sulfide Detection Kit allows the winemaker to conduct lab trials to detect and establish treatment levels for off-odors in wine due to sulfide compounds.

COMPONENTS OF KIT

Ascorbic acid, 1% solution, 1 oz dispenser
Copper (cupric) sulfate ($CuSO_4 \cdot 5H_2O$), 0.05% solution, 1 oz dispenser
Copper (cupric) sulfate ($CuSO_4 \cdot 5H_2O$), 1% solution, 2 oz dispenser
Disposable Pipets, 0.5 mL (3)

BACKGROUND

A range of sulfide compounds occur naturally in the winemaking process but many have negative sensory effects which require treatment. The generation of these sulfide compounds can be frustrating for the winemaker because there is not a clear understanding and consensus on how to avoid them. It is generally agreed that the two main causes of sulfide compounds in wine are: 1) the late season use of elemental sulfur sprays in the vineyard and 2) the generation of sulfide compounds during fermentation by yeast which are stressed due to low nitrogen content in the must or juice.

Provided one can be assured that the first issue is not a problem, then the winemaker is generally focused on trying to make certain that yeast can finish a fermentation cleanly, without stressing and generating sulfide compounds. This problem is addressed by measuring the yeast assimilable nitrogen (YAN) content of the unfermented must or juice, and then adding yeast nutrients to make up for any deficiency. Gusmer has a range of products (the MicroEssentials line) which we believe are the best nutrients on the market to give yeasts the supplements they need to complete clean fermentations with no residual impact on the wine. Sulfide production during fermentation can also be addressed with the selection of non-sulfide producing yeast (Renaissance Yeast) that are incapable of producing sulfide compounds.

Despite the general agreement on the two issues above, there is still no fool-proof way to avoid sulfide generation in wines. Furthermore, there is not a full consensus on the best way to treat sulfides including the timing of treatments. Part of the problem is that the range of sulfide compounds is very broad and it is difficult to identify which of those compounds are present in a particular wine.

Sulfide compounds are generally classified into these categories: Hydrogen sulfide (H_2S), mercaptans and di-sulfides. H_2S has the classic rotten egg smell. The other compounds emit a range of odors characterized as garlic, onion, sewage and rubber. Sulfide compounds, at low levels, have the ability to mask or mute fruit also, as opposed to imparting obviously off-odors.

It is generally agreed that the best way to treat these compounds is by the addition of copper (in the form of cupric sulfate penta-hydrate) or a combination of ascorbic acid followed by copper. Copper will react directly with H_2S and mercaptans to form copper sulfide (CuS) which has no aroma.

In order to treat the higher molecular weight di-sulfides, it is necessary to first use ascorbic acid. Ascorbic acid is required to break the di-sulfide bond to transform that compound into mercaptans which will react directly with copper. It is important to note that the breaking of that di-sulfide bond

occurs in a low redox setting – the ascorbic acid is designed to shift the redox potential of the wine. So when ascorbic acid is used for this purpose, it is even more important to keep barrels topped with adequate SO_2 levels, and to give the ascorbic acid time to work (about 4-5 days in production settings) before copper is added.

Finally, it is most important to note that there are many sulfide compounds which do not respond to this treatment. Examples of these include di-ethyl sulfide (DES) and di-methyl sulfide (DMS). Historically, there has been no good or predictable way to treat these, but vendors of reverse osmosis and other micro-filtration equipment claim to be able to extract these from wine.

In summary, it is difficult to predict how well treatment will work. There are cases where treatment of a horribly off wine with ascorbic acid and copper can miraculously clean it up. But, for reasons cited above, there are cases in which treatment does little good. Most often, the result of treatment is an improvement to the wine which falls short of complete eradication of the off odors – but this result may be enough to save a wine on its own, or at least make it worthy for blending.

The purpose of this kit and the lab trials, of course, is to make that final result as positive and predictable as possible. And because lab trials do not always translate perfectly into production results, it is strongly recommended that the lab trial results are used to treat a portion of the production wine first. Make sure you are happy with those results – then treat the entire lot.

SPECIFIC LAB TRIAL INSTRUCTIONS

First, you will try to determine what classes of sulfides are in the off wine, as well as get an initial impression of how well they respond to treatment.

1. Put about 30 mls of the wine into each of 3 glasses.
2. Add 6-8 drops of the ascorbic acid solution to Glass 3.
3. Wait about 5 minutes, then add 6-8 drops of the copper solution to Glasses 2 & 3.
4. Evaluate the aroma of the wine (drinking not advised):
    a. Glass 1 is the untreated control.
    b. Glass 2 is treated with copper only. That will react with H_2S and mercaptan. If the odor is fully cleaned up, then treatment with copper only is indicated.
    c. Glass 3, with ascorbic acid followed by copper, will treat some di-sulfides as well as the H_2S and mercaptans. If this glass smells clean, or significantly cleaner than Glass 2, then treatment with both ascorbic acid and copper is indicated.

The second stage of this process is to identify specific treatment levels by generating a few treated samples. Usually, 3 sample trials are adequate. Generally, we would choose treatment with ascorbic acid in the range of 20-100 ppm and treatment with copper in the range of 0.2 - 0.5 ppm, depending on how strong the off odor is and how well it seemed to respond in the initial evaluation above.

As an example: If a wine has significant sulfide odors but responded reasonably well to ascorbic acid and copper (i.e., Glass 3 showed significant improvement), then you could set up the following 3 trial levels-

Trial 1: 25 ppm ascorbic acid followed by .3 ppm copper.
Trial 1: 50 ppm ascorbic acid followed by .4 ppm copper.
Trial 1: 75 ppm ascorbic acid followed by .5 ppm copper.

Using the tables provided, add the correct amount of ascorbic acid solution to the sample size chosen, then wait 24 hours. Add the correct amount of copper solution, and wait another 24 hours. Then evaluate.

It is important not to leave headspace in the sample bottles, as that can cause variation through oxidation. It is also a good idea to put an untreated control sample of the wine into the same sample container at the same time to control for effects of any oxygen uptake. This is particularly true if the wine is well past fermentation or is a more delicate varietal.

After you have made the assessment of the 3 trial samples, you could do more trials at different levels or you could move to treatment of the production wine. A couple of important points to note:

- If you want use more aggressive treatment levels that is fine, but be aware that total copper additions cannot exceed 6 ppm, and there is a legal limit to residual copper in finished wine (currently 0.5 ppm).
- No matter how many lab trials you perform, it is still a good idea to treat a portion of the production first, such as one barrel or even a 5 gallon carboy. If you are happy with that result, then treat the entire lot.
- For reasons noted above, it is important to give the ascorbic acid time to work. Wait 4-5 days before adding the copper.

TABLES FOR LAB TRIALS

Ascorbic Acid Additions for Lab Trial Samples

mL of 1% ascorbic acid solution to add to the following sample sizes

PPM of Ascorbic Acid	100 ml	375 ml	750 ml
10	0.1	0.38	0.75
30	0.3	1.13	2.25
50	0.5	1.88	3.75
100	1.0	3.75	7.50

Copper Additions for Lab Trial Samples

mL of 0.05% copper sulfate solution to add to the following sample sizes

PPM as Copper	100 ml	375 ml	750 ml
0.1	0.08	0.30	0.6
0.2	0.16	0.60	1.2
0.3	0.24	0.90	1.8
0.4	0.32	1.20	2.4
0.5	0.40	1.50	3.0

* Note: copper calculations are based on the fact that copper is about 25% of cupric sulfate penta-hydrate, by weight.

TABLES FOR PRODUCTION TREATMENT OF WINE

Ascorbic Acid Additions for Treatment in Production

Grams of Ascorbic Acid (solid crystals) to add per lot size

PPM of Ascorbic Acid	1 Gallon	1,000 Gallons	100 Liters
10	0.04	37.9	1.0
30	0.11	113.6	3.0
50	0.19	189.3	5.0
100	0.38	378.5	10.0

Copper Additions for Treatment in Production

mL of 1% copper sulfate solution to add per lot size

PPM as Copper	1 Gallon	1,000 Gallons	100 Liters
0.1	0.15	150	4.0
0.2	0.30	300	8.0
0.3	0.45	450	12.0
0.4	0.60	600	16.0
0.5	0.75	750	20.0

For larger volumes of wine, you may use 10% copper sulfate solution, or crystals. When using a 10% solution, divide the mL of 1% solution needed by 10. When using crystals, divide mL of 1% solution by 100 to calculate grams of copper sulfate crystals for addition.

* Note: copper calculations are based on the fact that copper is about 25% of cupric sulfate penta-hydrate, by weight.

Important Note: Gusmer Enterprises, Inc. provides this information to the best of our knowledge. This information does not claim to be complete and Gusmer Enterprises, Inc. cannot assume liability for improper use. All users are advised to test products to meet their specific needs.

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