

Copper Sulfate Trial

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Hydrogen sulfide and other “sulfide-like” off aromas are commonly observed problems during fermentation. Sometimes these off odors are not very conspicuous and tend to mask the fresh and fruity aromas that one expects to find at the end of a sound fermentation.

If lack of fruitiness or the presence of a slight dirty aroma in a young wine is a problem; then it is important to determine if such a problem is due to sulfides in the wine.

One approach is to conduct a copper addition trial to determine if the off odor can be removed. Copper treatment of the wine is often helpful in removing unpleasant odors due to H₂S and mercaptans. In case the copper treatment fails to remove the off odor, the problem may be some other factor and not the sulfides.

The procedure for conducting a copper addition trial is given below.

The first step in copper treatment is to experimentally determine the amount of copper needed for wine treatment. This can be achieved by the following procedure.

1. Prepare a 1% copper sulfate solution. To make this solution, weigh 1 gram of copper sulfate (CuSO₄ · 5H₂O), dissolve in a small amount of distilled water in a 100 ml volumetric flask and bring to volume. Label this as 1% copper sulfate solution.
2. Prepare a 0.004% copper sulfate solution for the trial by pipeting 1.0 ml of 1% copper sulfate solution into a 250 ml volumetric flask and bring the volume up to 250 ml with distilled water. Label this copper sulfate solution as “stock solution, 0.004% copper sulfate.” Be careful not to confuse the two copper sulfate solutions.
3. Label five 100 ml volumetric flasks with numbers 1 through 5.
4. Leave flask number one aside and pipet 0.5 ml, 1.0 ml, 1.5 ml, and 2.0 ml of 0.004% copper sulfate solution into flasks numbered 2, 3, 4, and 5, respectively.
5. Add wine to all the flasks to bring the volume to 100 ml. Mix the contents well. Close the flasks and leave for several hours. Note that 1 ml of 0.004% copper sulfate solution in 100 ml of wine equals 0.1 ppm of copper. The concentration of copper in various flasks will be as follows.

6. After allowing some time (several hours or preferably overnight) for the copper to react with H₂S, the samples should be ready for evaluation.

7. To evaluate the improvement in aroma, the wine from flask #1 should be compared by sniffing, with wines from flask #2 through #5. The amount of copper needed to treat a wine can be determined by selecting the sample showing maximum aroma improvement (disappearance of H₂S odor) with the least amount of copper added.

If the copper addition of 0.05 to 0.2 ppm does not remove the objectionable odor, higher levels of copper up to 0.5 ppm can be tried. Most of the added copper will react with H₂S and be lost in racking after the treatment. However, a small portion of it could remain in the wine. The vintner must make sure that the residual copper level in finished wine does not exceed 0.2 ppm. Persistence of the dirty and unpleasant H₂S-like odor

after copper treatment may be due to the presence of a complex sulfur compound such as dimethyl disulfide. This compound does not react with copper. To remove it, the wine needs to be treated with ascorbic acid which will convert dimethyl disulfide to a more reactive species, such as methyl mercaptan. After the ascorbic acid additions, copper addition trials should be conducted to determine the amount of copper needed to treat the flawed wine.

Table 1. Concentration of copper

Flask	ml of 0.004% copper sulfate added	Concentration of copper in 100 ml of wine (ppm)
1	0.0	0.00
2	0.5	0.05
3	1.0	0.10
4	1.5	0.15
5	2.0	0.20

Copper addition to wine

Copper addition to the entire lot of wine should be considered only after the correct amount of copper to be added is experimentally determined. For copper treatment, 1% copper sulfate solution should be used. The correct amount of 1% copper sulfate solution required can be obtained from the table given below.

Table 2. Correct amounts of 1% copper sulfate solution

ppm copper required	ml of 1% CuSO₄ · 5H₂O solution required		
	per gal	per 10 gal	per 100 gal
0.05	0.075	0.75	7.5
0.10	0.150	1.50	15.0
0.15	0.225	2.25	22.5
0.20	0.300	3.00	30.0
0.25	0.375	3.75	37.5
0.30	0.450	4.45	44.5
0.35	0.525	5.25	52.5
0.40	0.600	6.00	60.0
0.45	0.675	6.75	67.5
0.50	0.750	7.50	75.0

The copper sulfate solution should be added while gently stirring the wine. After a couple of days, the wine should be evaluated for aroma improvement; then filtered to remove the residual copper.

Residual copper must be tested to make sure the amount is low enough to comply with BATF regulations and to ensure shelf life. This can be achieved by getting a commercial wine laboratory to do the copper determination.