

HYDROGEN SULFIDE IN FERMENTATIONS

by
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Hydrogen sulfide (H_2S) is a colorless, flammable gas, and it produces the distinctive odor of rotten eggs. The nose is very sensitive to H_2S , so minute quantities of this gas can easily be detected. Most people can detect less than one part per million of H_2S , so very small quantities of hydrogen sulfide can completely spoil a fine wine. In smaller amounts, hydrogen sulfide can give wines a skunky or rotten cabbage odor. In even smaller quantities, H_2S may not produce a recognizable odor, but it often destroys the fruity nose of the wine.

Any hydrogen sulfide problems should be corrected as soon as they are detected. Unless hydrogen sulfide is removed from wine promptly, it can react with other wine materials forming mercaptan. Then, mercaptan can be oxidized into disulfide. Disulfide also produces very disagreeable odors and disulfide is very **difficult** to remove from wine successfully.

Avoiding H_2S

Hydrogen sulfide gas is often produced from elemental sulfur during primary fermentation. Grapes are often treated with sulfur sprays to control powdery mildew, and the residual sulfur on the grapes is transferred into the juice. The sulfur is then converted into hydrogen sulfide by the reducing atmosphere of fermentation. To avoid this problem, most grape growers stop spraying with sulfur several weeks before harvest time.

Sometimes, hydrogen sulfide is encountered during fermentation even when the grapes contain no residual sulfur. Here the problem occurs because the yeast runs short of some needed material. Hydrogen sulfide can be produced when yeast lacks micro-nutrients or vitamins including *pantothenic acid*. A common cause of stinking fermentations is a lack of nitrogen, and mild cases of H_2S can often be cured by adding a small quantity of DAP to the fermentation. Many winemakers add extra nitrogen, micro-nutrients and *pantothenic acid* to their fermentations specifically to avoid the production of hydrogen sulfide gas. Diammonium phosphate is often used as a source of nitrogen, and proprietary yeast foods such as Super Food (from the Wine Lab) can be added to provide micro-nutrients. *Pantothenic acid* is one of the B-vitamins, and it can be obtained at any drug store.

Some strains of yeast produce more hydrogen sulfide than other strains. Montrachet yeast is a particularly bad offender, and it has fallen into disfavor in recent years because of this tendency. Montrachet yeast should never be used with grapes containing residual sulfur dust.

Hydrogen sulfide can also be produced when wine is left on the gross lees for long times. Winemakers avoid this problem by promptly racking new wines off the gross lees, or by periodically stirring the wine when long lees contact times are desired.

Removing H_2S by Racking

Hydrogen sulfide should be removed promptly because it becomes more difficult to remove the longer it stays in the wine. Home winemakers often use the following procedure to remove hydrogen sulfide from wine. (1) About 50 milligrams per liter of sulfur dioxide is added to the wine (1/4 tsp. of sulfite powder in 5 gals) when fermentation is complete. (2) The wine is then aerated by racking with a great deal of splashing and bubbling to blow off the H_2S gas. (3) The sulfur dioxide in the wine then converts the remaining hydrogen sulfide back into elemental sulfur, and the sulfur settles to the bottom.

of the storage container. (4) After a week or two, the wine should be racked or filtered to remove the elemental sulfur, or the smell may reappear. Sometimes a stinky wine needs to be racked two or three times to remove the stench completely.

Aeration is often effective in treating mild cases of hydrogen sulfide. **But, aeration should be used with caution.** Aeration may oxidize mercaptan in the wine into disulfide, and disulfide is as stinky as H₂S and much more difficult to remove.

Removing H₂S with Copper Sulfate

Copper converts hydrogen sulfide gas in wine into a solid material called copper sulfide and the copper sulfide has no odor. Copper sulfide is not soluble in wine, and it settles to the bottom of the tank.

After a few days, the winemaker racks or filters the wine off the copper sulfide residue. Some home winemakers rack their stinky wine through a clean piece of copper screen, or they place a few copper pennies in the wine container. But, placing copper metal in wine is not a good idea. Wine has a low pH, and acid in the wine can easily dissolve too much copper. Excessive amounts of copper may be deposited in the wine, so copper metal in wine should be used with care.

Professional winemakers prefer to use a 1-% solution of copper sulfate pentahydrate to remove H₂S because the amount of copper added can be accurately measured. A simple method of removing H₂S is to add enough 1-percent copper sulfate solution to produce about 0.1 ppm of copper in the wine.

Then the wine should be stirred thoroughly, and after a few hours, the wine should be carefully smelled. Figure 1 can be used to determine how much of the 1- percent copper sulfate solution is needed for a 0.1 ppm treatment.

One treatment is often enough, but a second or even a third treatment may be necessary for difficult cases. The wine should be left undisturbed for several days after this treatment so the copper sulfide (a very fine black powder) can settle to the bottom of the container. Then the wine should be carefully racked off the copper sulfide residue.

The following rules may be helpful when using copper to remove hydrogen sulfide odors from wine. (1) Never add copper to active fermentations. Copper sulfate added during fermentation often causes **more** hydrogen sulfide to be formed. (2) Only small quantities of copper sulfate solution are required, so use a pipette and measure carefully. (3) Add the 1% copper sulfate solution in small (0.1 ppm) doses rather than a single large dose. Very little copper will remain in the wine when copper sulfate is used in this way. More copper can be added if needed, but excessive amounts of copper are difficult to remove from wine. (4) The TTB limit for copper in wine is 0.5 ppm so avoid adding much more than 0.5 ppm total.

Gallons of Wine	Milliliters of 1% Solution
5	1
10	2
15	3
20	4
25	5
30	6
35	7
40	8
45	9
50	10
100	20
500	100

Figure 1. Milliliters of 1% copper sulfate solution needed to produce 0.1 ppm of copper.

Summary

Hydrogen sulfide gas produces a rotten egg smell in wine, and very small quantities of hydrogen sulfide make a wine undrinkable. Hydrogen sulfide production can be minimized by avoiding grapes containing excess sulfur, by adding extra yeast nutrients, by avoiding Montrachet yeast and by racking new wine promptly. Racking with aeration may be successful in mild cases of hydrogen sulfide, but carefully adding small quantities of copper sulfate is the preferred treatment.