This article deals with wine stinks due to Sulphur compounds: how to treat them should you have a stinky wine. A companion article “Adding Nitrogen to musts” details how to prevent your wines from going stinky in the first place.

What are wine stinks?

The stinky element in wine is, initially, hydrogen sulphide, H_2S. This compound is commonly called rotten egg gas, and smells, well, eggy. Tiny traces of it can actually improve some wines but it is not stable and will react with other wine species to create much nastier stinks if given the chance. So it is best to avoid producing it in the first place.
Hydrogen sulphide is an unwanted by-product of the fermentation process. Wine yeast is hungry for Nitrogen and if there is none readily available the yeast will break down grape protein to secure its Nitrogen needs. Grape protein also contains Sulphur, so this is released in the form of hydrogen sulphide, and the wine stinks. You avoid this scenario by ensuring that the grapes have adequate levels of yeast available nitrogen,YAN[1].

There are other scenarios where the yeast produces hydrogen sulphide, collectively described as yeast stress. The yeast gets too hot, or too cold, or just gets cranky. So use an appropriate yeast strain for the kind of wine you are making. Also, keep your ferments in the temperature range specified by the yeast manufacturer, and think ahead when pressing off red wines to avoid temperature shock.

Fermentation is a reductive[2] process. Hydrogen sulphide is a sign of reductive processes. Ensuring an adequate supply of oxygen early in the ferment is therefore important. Red wine is a reductive compound particularly in fermentation and immediately afterwards so some stinking is to be expected in most red wine ferments, particularly late in the fermentation. The oxygenation that results from pumping over[3] keeps these reductive stinks at bay and can be continued post fermentation if necessary.

White wines can also stink. If not aromatic sorts you can pump them over like red wines to blow off the stink. But if they are aromatic sorts you can really only pump them over on day 2 or 3 of the ferment before you risk losing aroma. Here, having the correct YAN for the yeast type, and careful temperature control, are the main strategies to prevent stinks. If copper sulphate is needed you should add it early while the stink is still “eggy”, even if the ferment is not finished. The method given later in this paper is recommended. Unfortunately some of the desirable aromas in white wines are from complex sulphur compounds and copper treatment may remove these along with the stink.

Another possible reason for hydrogen sulphide production is the presence of Sulphur spray residues on your grapes. The fermenting yeast will produce hydrogen sulphide in potentially disastrous quantities in this situation, often leaving the wine permanently spoiled.

Nasty stinks.

When hydrogen sulphide is allowed to remain in a wine it can take part in various chemical reactions with other wine species and may produce nasty stinks. Hydrogen sulphide is “easily” treated by pump over or copper treatment and can be completely removed from the wine. Some of

1 See the article “Adding Nitrogen to musts” for a discussion of YAN.
2 Reductive = lacking oxygen.
3 Pumping over is the process of withdrawing wine or grape must from the bottom of the (open) fermenter and returning it to the top, usually with splashing. Sufficient liquid needs to be moved to equal five times the apparent ferment volume.

the nasty stinks are more difficult to remove, and some cannot be removed.
Mercaptan forms when hydrogen sulphide reacts with (ethyl) alcohol. Mercaptan is more stinky than hydrogen sulphide. So if you didn't remove all of the hydrogen sulphide, because you didn't/couldn't detect it, with time in the bottle it can react to form mercaptan. Because mercaptan is smellier than hydrogen sulphide the wine “mysteriously” reacquires a stink. Fortunately mercaptan stinks respond to copper addition.

Disulphides are another class of stinky compounds that may form from hydrogen sulphide reactions in wine. These are less stinky than either mercaptan or hydrogen sulphide so may not be noticed. But some are reactive, and can revert to mercaptans after the wine gets it's bottling dose of sulphur dioxide. Mercaptans being particularly stinky, again the mysterious stink strikes!
These are only a couple of the many possible stinks that may develop in wines when hydrogen sulphide is left untreated. [4]

Treatment of hydrogen sulphide in wine

All wine should be assessed for the presence of hydrogen sulphide (H_2S) during and immediately after fermentation. If the assessment indicates the presence of H_2S and the wine is still fermenting, the H_2S is best removed by:
i) addition of yeast nutrient(s) if the wine is in the first half of its ferment or
ii) pumping over, which will remove the smell from the wine but not necessarily prevent production of more smells.
iii) Treatment with a solution of copper sulphate.
Post fermentation stinks are removed by either:
a) where oxidation is not a concern5, pumping over until the stink disappears, or
b) stirring the yeast lees if appropriate (often ineffective), or
c) treatment with copper sulphate solution.
Other stinks e.g. mercaptans may respond to copper treatment provided that the wine is well sulphited.

Hazards of copper treatment.

Copper is a toxic heavy metal and limits apply to its concentration in foodstuffs. Should assessment indicate that more than 10 drops (in the test below) is needed to clean up a stink, you may exceed the allowable level of copper. Here you need to pursue other options, ie blending with a wine that does not require copper treatment.

It is critical to add the dose to the whole container of wine slowly with intense agitation. In this way, most of the copper added will react with H_2S and not remain in the wine. It produces a harmless sediment of copper sulphide that will be removed at the next racking.
Copper is a catalyst for wine oxidation. For this reason, wine treated with copper tends to oxidise more readily than untreated wine requiring careful attention to free SO_2 levels.

4 A full discussion of these stinks can be found at https://www.awri.com.au/industry_support/winemaking_resources/storage-and-packaging/pre-packaging-preparation/removal-volatile-sulfur-compounds/

5 Immediately post fermentation, before MLF, red wines have a capacity to consume considerable quantities of oxygen to stabilise colour and soften tannins, without becoming oxidised. After MLF and sulphiting, they can still tolerate oxygenation though to a lesser extent. After pumping over a sulphited wine you should check the free SO2 level and adjust if necessary.

Assessment

*This procedure requires the use of **2grams per litre** copper sulphate solution. Commercial solutions are usually 20g/l.*
The procedure is as follows:

1. First dilute the 20 grams per litre copper sulphate solution 1:10 in water as follows: take one volume of 20 g/l solution and add 9 volumes of water. Melbourne tap water is OK. Label as "Copper sulphate 2 grams per litre" and keep this solution.
   Calibrate your dropper: count the number of drops needed to make 1ml. Record this number (n).
2. Pour 100 ml of wine into each of 4-6 tasting glasses.
3. While swirling vigorously, add one drop of 2 grams per litre copper sulphate solution to glass 2, two drops to glass 3, and so on. (Add no copper to glass 1.)
4. Assess the wines by smell. When addition of copper causes a distinct improvement to the smell, H_2S is present in the wine. *Individuals vary substantially in their ability to recognise wine stinks so it is a good idea to get a second person to corroborate.*
5. If the last glass in the series smells better than the second last, the test should be extended until you detect no improvement with further additions of copper.
6. Note the number of drops of copper that produced the best result. (N)

Treatment with copper

If you have determined that copper treatment is required, follow the assessment procedure above. *Note that copper treatment is only one of the possible options.*

a) Carry out the assessment procedure above. Note the number of drops of 2 grams per litre copper sulphate necessary to fix the problem (N).
b) Calculate the required addition *of 20 grams per litre* copper sulphate to the wine tank as per the formula:

addition (mls of 20 grams per litre copper sulphate) = N*V/n, where

N is the number of drops from 6 above, V is the volume of wine in litres to be treated, and n is the number of drops per ml from 1 above.

c) Add the 20 grams per litre copper to the wine *slowly with intense agitation.*
d) Take more than usual care of the treated wine, it may be more prone to oxidation than untreated wine.