**Appearing (and reappearing) H2S in wine**

Problem: H2S is a common contributor to sulfur-like off-aromas in wines, and may be produced in excess during fermentation. It has also been shown to reform during storage under reductive conditions.

Major causes of H2S during fermentation

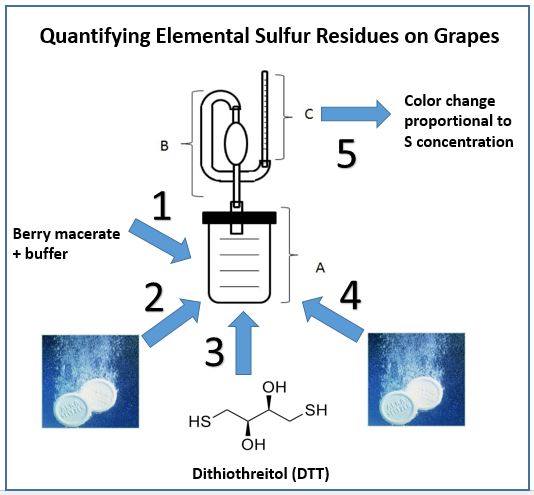
1. **Amino Acid Biosynthesis:** H2S is an intermediate in the biosynthesis of cysteine and methionine. In the absence of sufficient yeast assimilable nitrogen, H2S will accumulate, diffuse outside of the cells, and cause a “rotten egg” smell.
2. **Reduction of Sulfur Residues:** Elemental sulfur is widely used for powdery mildew, will result in increased H2S during fermentation. This is a separate pathway from amino acid biosynthesis and cannot be prevented through nutrient addition.

* *How late can I spray?*

Sulfur residues on fermented grape must should be kept < 1 mg/kg to avoid increased H2S production during fermentation. Sulfur residue persistence on grapes varies with several factors

* Weather conditions: warmer condition
* Formulation and rate: “Stickier” formulations, e.g. Microthiol will persist longer than simple forms like wettable sulfur, as will higher application rates
* Pre-fermentation practices: clarifying grape must – standard practice for most wine wines - can lower S-residues by >95%
* *Quantifying Sulfur Residues*

Because of the variability in sulfur persistence, direct measurement is often advisable. Residues on grape must can be quantified using a simple, colorimetric assay, shown below



More information on this method is available at: [www.extension.org/pages/69748/analyzing-elemental-sulfur-residues-on-grapes](http://www.extension.org/pages/69748/analyzing-elemental-sulfur-residues-on-grapes) (written protocol)

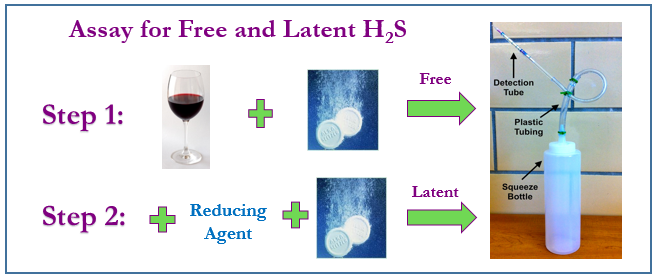
* *What if residues are too high?*
  1. Delay harvest, if possible – weathering will help to reduce sulfur residues.
  2. Clarify your juice – for whites and roses, clarification can remove >90% of sulfur.
  3. Copper salt additions during fermentation? Be careful . . . see the next paragraph

Causes of H2S during storage

* H2S can reform during storage under low-oxygen conditions. Potential precursors include:
  + Copper sulfide complexes: Copper fining will temporarily resolve off-aroma problems by forming odorless complexes. However, these complexes are not easily removed by filtration, and can serve as a reservoir of H2S if they stay in the wine. Measure your residual copper if you do copper additions!
  + Elemental sulfur degradation products. These species have not been fully characterized yet, but may be polysulfides.
* There may be other sources of H2S in stored wines, including degradation of cysteine (an amino acid).

Predicting H2S formation in wines

* Brine dilution in combination with colorimetric gas detection tubes, will detect the presence of copper sulfide complexes.
* Reducing agents, such as TCEP, are currently being investigated for the detection of other latent H2S sources, including elemental sulfur degradation products.
* These detection methods are simple, inexpensive, and require minimal specialized equipment, making them suitable for small-scale operations.



What can be done?

* The classic technique of copper fining is not recommended, since the formation of copper sulfide complexes is shown to be reversible during storage.
* Highly reductive storage conditions (e.g. screw cap closures) should be avoided for wines at risk of developing reductive character.