

Sensory Evaluation of the 2007 Texas A&M Commercial Wine Chemistry Trials

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Introduction

Wine is basically a chemical “soup” produced through a series of biological and chemical reactions. The job of the winemaker is to nurture the processes which ultimately yield subjectively favorable outcomes while at the same time inhibit processes which are perceived to have negative impact on the final product. The outcome of this cascade of interconnected reactions is a product of the wine’s environment. This environment, provided by the winemaker, has the greatest influence on whether the finished wine will have flaws or will be flawless. It is common knowledge that a myriad of variables influence wine quality. While many of these variables are out of the control of the winemaker, i.e. seasonal environmental influences in the vineyard, still more are influenced directly by a winemaker’s production decisions. The most commonly found flaws in wine may be easily prevented. This study focuses on Texas wines and the occurrence of Sulfides (Sulfidic Off Odors), *Brettanomyces*, Acetaldehyde and Volatile Acidity therein.

Sulfides, sulfidic compounds and Sulfidic Off Odors (SLO) in wine are one of the most commonly occurring wine flaws. The term “sulfide” is commonly used to identify a class of compounds including, but not limited to hydrogen sulfide, mercaptans, disulfides, dimethyl sulfide and thiols. When present in wine, these compounds may impart unsavory aromas of rotten egg, sewage, and feces to name a few. Yeast fermentation stress is the most common cause for the existence of “sulfides” in wine, although there are other possible causes. Fermentation stress can be caused by improper fermentation temperature, improper fermentation rate (too rapid), unsound fruit, or poor nutrient status. Most commonly, fermentation stress is caused by poor must nutrient status. If a nitrogen deficiency exists during initial yeast growth phase, yeasts are not able to produce the essential sulfur-containing amino acids cysteine and methionine and thus begin to excrete hydrogen sulfide (Butzke, 1997). Mercaptans are believed to be formed by reactions involving hydrogen sulfide and alcohols. Disulfides are produced when mercaptans combine through oxidation.

Brettanomyces (*Brett.*) is a wild yeast which can impart phenolic aromas oftentimes described as having the aroma of “band aids”, “wet horse” or “barnyard”. In lower concentrations, *Brett.* can impart a desirable spiciness and complexity to wine. Once present in a winery, *Brett.* is arguably impossible to remove. In addition to more commonly occurring sugars in wine, *Brett.* can survive by metabolizing pentoses as well, which are common in wine oak products and barrels. As it is impossible to “sterilized” wood, once present in wine barrels, *Brett.* should be considered resident, especially if oak will continue to be used. Wines with high pH are more susceptible to Brett infection as are wines of lower alcohol and those containing residual fermentation nutrients. Additionally, *Brett.* can thrive at cellar temperatures above 50F. *Brettanomyces* is inhibited by proper wine SO₂ levels.

Acetaldehyde is yet another commonly occurring wine flaw. When present in wines at elevated levels it produces a distinct “sherry-like” aroma. Acetaldehyde production in wines may be caused by microbial activity (“film” yeast or aerophillic bacteria) or it may be produced chemically by the oxidation of ethanol. Acetaldehyde formation is common in wines which are improperly stored (not “topped up”), processed too

aggressively where oxygen is concerned (excessive splashing) or those which have low levels of free SO₂.

Volatile Acidity, commonly referred to as VA, is a measurement of volatile acids in wine, comprised primarily by acetic acid, but includes as well ethyl acetate and others. It is a natural product of fermentation and is thus in all wines present in small quantities. An elevated level of VA present in wine is usually the result of unwanted microbial activity in conjunction with wine oxygen exposure. Common microbes responsible for elevated VA content in wine include, *Acetobacter*, wild yeasts and lactic acid bacteria. These offenders are very sensitive to SO₂. Wine yeasts (*Saccharomyces cerevisiae*) when stressed may also produce elevated levels of VA. Some causes of wine yeast stress include fermentation temperature stress (too high, too low), improper must nutrient status (nutrient level too high or too low), as well as fermentative inhibitors (pesticide residue, elevated acetic acid from unsound fruit), and high Brix (high osmotic pressure) fermentations. Legal limits in wine (U.S.) are 1.2g/L VA for red wines and 1.1g/L for whites.

Materials and Methods

1. Wines were submitted by Texas wineries who wished to participate in the *2007 Texas A&M Commercial Wine Chemistry Trials*. Fifty-one Texas wines were submitted to Texas A&M for chemical analysis. In addition to basic lab analysis which established each wine's pH, titratable acidity and turbidity, wines were tested for individual phenolics (gallic acid, (+)-catechin, (-)-epicatechin, and resveratrol), color density, hue/tint, total anthocyanins, total soluble phenolics, antioxidant capacity, monomeric-polymeric anthocyanins, ammonium, potassium, glucose and lactate.
2. Participating wineries were as well asked to complete a survey (*Wine Sample Survey*) regarding practices utilized during the production of each submitted wine.
3. Wines that were submitted to the *2007 Texas A&M Commercial Wine Chemistry Trials* with a completed *Wine Sample Survey* were evaluated sensorially for the presence of flaws.
4. The results of the sensory evaluation performed on each survey-complete wine was then compared to the data on its respective *Wine Sample Survey* and as well to the results of lab analysis performed during the *2007 Texas A&M Commercial Wine Chemistry Trials*.

Results and Discussion

The following results were found of the wines remaining after the completion of the *2007 Texas A&M Commercial Wine Chemistry Trials (36 wines)*, which had a corresponding completed *Wine Sample Survey (24 wines)*:

It was found that 54.17%, exhibited flaw-level Sulfidic Off Odors (SLO). While 69.23% of these wineries made pre-fermentation nutrient additions to the must, the remaining 30.77% did not. None however performed analysis to determine nutrient status of the must, nor did they send away for like analysis. Only one respondent in this group did not control fermentation temperatures. Wines which exhibited flaw-level *Brettanomyces* aromas comprised 25% of the 24 evaluated wines. Of these wines, half had a pH of 3.75 or higher. Of these *Brett.* infected wines, 66% made no SO₂ additions until the completion of primary and secondary fermentations, 16.7% maintained SO₂ levels on a regular basis throughout the life of the wine, 16.7% added yeast nutrients based on lab analysis and 16.7% sterile filtered the final product. Of the 24 wines reviewed, 16.7% had flaw-level acetaldehyde aromas of which only 50% maintained SO₂ levels throughout the life of the wine (check and adjust at least every 3 months). Of the 24 wines reviewed, .04% had flaw-level Volatile Acidity aromas, reporting that no SO₂ or fermentation nutrient additions were made prior to completion of primary and secondary fermentations. Additionally, SO₂ levels were checked and adjusted every three months.

Applications of Research

1. All of the wine flaws addressed herein are positively influenced by timely and accurate SO₂ additions. Molecular SO₂ between 0.5mg/L and 0.8 mg/L is a generally accepted level for healthy wines. To avoid over-sulfiting at higher wine pH however, the winemaker should consider a more holistic approach to wine stability.
2. Supplying proper pre-fermentation nutrient levels will result in a healthy fermentation, minimizing the occurrence of SLO as well reducing the risk of a post-fermentation “nutrient pool”. A “pool” such as this provides an energy source for wine microbes.
3. Proper fermentation temperatures and rates can minimize fermentation yeast stress thus reducing the incident of SLO.
4. Proper cellaring temperatures (50-55F) will aid in inhibiting the growth of *Brettanomyces* in wines.
5. Acetaldehyde and VA formation in wines may be minimized by maintaining proper SO₂ levels. Additionally wine should be stored in “topped vessels” (completely full) thus minimizing wine to air contact. Wine should as well be treated as gently as possible, avoiding unnecessary oxygenation.

References

Butzke, Christian E. (1997). Of Rotten Eggs, Burnt Rubber and Cooked Cabbage: a review and update on sulfide formation in wine. *American Vineyard*, March 1997.