From Must to Glass

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Abstract

In conjunction with local East Texas wineries, protocols are being developed to measure different parameters associated with wines; pH, titratable acidity, specific gravity, refractive index/sugar content, and free SO_2 (sulfites). Wines will be tested at four times during the production process. The results of all of the analyses will be included in a database used in wine analysis. Once these first protocols are complete, additional protocols will be developed to analyze for other parameters including dissolved oxygen, YAN, Formal number, alcohol content, organic acids, and color. The development of a laboratory to test all these parameters for local area producers and the inclusion of the data in the current wine database will allow for East Texas wineries to produce consistent and quality products.

Introduction

The process involved in manufacturing wines is quite extensive and requires constant monitoring to produce a quality product. The wine is tested at least 4 times during the process to ensure that certain benchmarks are met. To assist the testing, wine can be scanned quickly using an instrument such as an OenoFoss WineScan, to make sure desirable levels are met. There are numerous parameters that are scanned, including; pH, titratable acidity, sulfites, dissolved oxygen, YAN, Formal number, sugar content, alcohol content, organic acids, and color. The results of the scan are compared to a database of wines, which is dependent on each wine having all of the chemistry done and included in the database. The chemistry is completed on each wine type at each of the four basic stages of wine production, starting with the crushed fruit before fermentation ever begins, and ending with the completed wine ready for consumption. Texas wines tend to not test well with the established database which is comprised of mostly California wines.

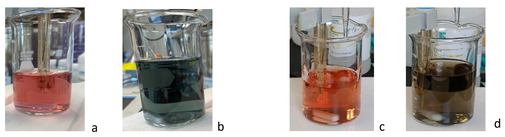

Figure 1. Color change seen in Naca Valley Vineyard Blueberry Wine (a → b) and Naca Valley Pinot Noir (c → d) during TA titration.

Figure 2. Color change seen in standardizing solutions for SO_2 titration.

Methods and Materials

In order to develop the database for East Texas wines, all of the wines must be tested to obtain average values for the different parameters being measured. This requires a series of different analyses to be done. The first two protocols being developed are for TA (titratable acidity) and SO_2 (free sulfite).

TA titration: A sample of wine is titrated using sodium hydroxide to a pH of 8.2 and the acidity is determined as grams tartaric acid/ L wine. This titration requires the standardization of the sodium hydroxide and the pH meter.

SO_2 titration (Ripper Method): A sample of wine is treated with sulfuric acid , sodium bicarbonate, and starch indicator. It is titrated with iodine solution until a color change to blue is seen. The sulfite concentration is determined in units of mg SO_2/ L wine. This titration requires the standardization of sodium thiosulfate and iodine solution, all which must be made fresh before the wine titration. This can be seen in Figure 2.

Specific Gravity: The specific gravity of each wine was measured using an Anton Paar DSA 5000A. This is used to determine the alcohol content of the wine.

Refractive Index/Sugar: The refractive index of each wine was measured with an Anton Paar Abbemat 3200. This is used to determine the sugar content of the wine.

pH: The pH of each wine was measured using an Accumet Dual Channel pH/ISE meter, standardized to pH 4, 7, and 10.

Results

TA Titration: The red wines acts as indicators, seen in Figure 1, due to compounds found in the grapes. This color change is not seen in white wines. The calculated TA content is shown in Table 1.

SO_2 Titration: There are many color changes associated with this titration. A starch indicator is added to the wine and it is titrated until the solution turns blue. Because of the intense red color of the red wines, this titration only works with white wines. The color change can be seen in Figure 3. The calculated SO_2 concentration is shown in Table 1.

Specific Gravity/Refractive Index/Sugar/pH: The results for all wines are shown in Table 1.

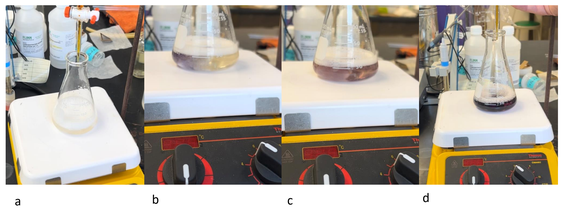

Figure 3. Color change seen in SO_2 determination in Sutter Home Pinot Grigio. The color change goes from a, just the wine sample, to d, blue.

Table 1. Results for all wines tested. Red wines were not tested for SO_2.

SURE 2023 Wine Analysis Data						
Sample	**pH**	**Tartaric Acid (g/L)**	**Refractive Index (nD)**	**Specific Gravity**	**Sucrose (g/100g)**	**SO_2 (mg/L)**
Naca Valley Vineyard						
Pinot Noir 2019	3.76	5.563	1.3450	0.993621	8.15	
Stage 3. Blueberry 2023	3.27	6.911	1.3417	0.993847	5.93	
Red House Winery						
Tempranillo 2017	3.75	4.504	1.3444	0.992638	7.74	
Casa Rossa 2019	3.56	5.874	1.3453	0.993962	8.36	
Sutter Home						
Merlot	3.53	5.780	1.3458	0.996549	8.68	
Pinot Grigio	3.51	6.443	1.3446	0.997076	7.91	32.651
Lemonade Wine Cocktail	3.59	7.716	1.3510	1.027937	12.03	
Boto Box						
Pinot Grigio	3.41	5.737	1.3429	0.995837	6.78	23.244
Madamemoiselle						
Muscat ~1998	3.63	4.413	1.3525	1.023683	12.97	

Discussion

The development of protocols for testing the TA and SO_2 in wines is complete. The values obtained for TA and SO_2 are well within published levels for the wines tested. The SO_2 titration works well for white wine and not for reds. To measure this quantity, a different detector will be required. An ORP (oxidation/reduction) electrode will be obtained and utilized in the SO_2 titration. This will work for both the reds and the whites and require no change in the protocol, other than detection method. The determination of the alcohol content depends on the specific gravity of the must before yeast is added and after the final fermentation and sweetening process.

Conclusions

The protocols for measuring pH, sugar content, refractive index, specific gravity, and titratable acidity are complete. These were simple modifications to existing methods. The protocols include the reagents needed, any standardizations required, and calculations. The protocol for measuring SO_2 works for white wines but not for reds. An ORP must be utilized and the Ripper Method modified for that inclusion. All reagents needed, standardizations, and calculations required for the SO_2 are included. The other analyses, (Formal number, YAN, organic acids) required more elaborate setups and will be addressed as this project continues.

To do a complete analysis of a wine, testing must be scheduled with the vineyard to coincide with the acquisition of the fruit. Naca Valley Vineyard will be starting a new wine in the upcoming months and we will work closely with them, from must to glass.

Acknowledgements

- *Partial funding for this project was provided by the Summer Undergraduate Research Experience sponsored by the College of Sciences and Mathematics at Stephen F. Austin State University.*
- *Additional funding was provided by a CARRI (Center for Applied Research and Rural Innovation) Grant at Stephen F. Austin State University.*
- *Additional funding was provided by the Department of Chemistry and Biochemistry Welch Foundation Grant, AN-0008.*
- *We would like to thank Naca Valley Vineyard for their continued support of this work.*
- *If there are any questions, please contact Dr. Alyx Frantzen, afrantzen@sfasu.edu.*

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