HARMONIZING EXPRESSION OF MEASUREMENT RESULTS IN WINE ANALYSIS: TESTING FOR TOTAL OR TITRATABLE ACIDITY (TA) OF WINE

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EXECUTIVE SUMMARY

This paper highlights the importance of using harmonized reporting of results (based on comparable tests) to facilitate trade in the global market.

- Reporting of TA as required by many governments for wine in international trade, serves as an illustration of the unnecessary complications that result when countries choose to express the results of a wine analysis in different ways.

- A potential solution to this problem is discussed; namely reporting TA in terms of grams per liter (g/L) of tartaric acid and selecting an agreed endpoint for the titration that is performed. Such an approach should help to minimize trade barriers among countries engaged in wine trade.

INTRODUCTION

As the wine market becomes increasingly globalized, there is a need for collaborative work aimed at minimizing the opportunity for trade impediments to be caused by disparate approaches to the expression of limits in relation to wine analysis. The Tbilisi Principles adopted by the World Wine Trade Group (WWTG) in 2014 (and a similar set of Principles endorsed by FIVS) provide guidance on alleviating some major impediments to wine trade. They recommend regulatory approaches to reduce unnecessary obstacles arising in part due to variations in terminology and analytical parameters used in wine analyses. One outcome at the 2015 International Wine Technical Summit (previously known as the International Wine Technical Forum),

which includes various government and wine industry technical experts, was the development of technical working groups tasked with demonstrating the practical implementation of the Tbilisi Principles in wine trade facilitation. This paper is the first product of the working group that is performing this activity in relation to Tbilisi Principle #06:

"Governments should adopt a common way of expressing analytical results in their rules, regulations, and requirement, where this is done in relation to a single wine constituent".

BACKGROUND

While laboratory analyses may play an important role in ensuring the quality and safety of a food product such as wine, wine producing countries frequently use different terminology, testing, and reporting units in their regulations to express limits for the same analytical parameters. Appendix A provides an overview of selected parameters in wine, the limits for which may be expressed on the basis of different wine constituents. In order to demonstrate the potential that exists for such confusion to occur and to cause problems in trade, the working group selected the laboratory test often referred to as 'TA' (an abbreviation for 'Total Acidity' or 'Titratable Acidity') as an example.

Analytical results for TA are often required in wine trade as an indicator of wine quality. The terms 'Total Acidity' and 'Titratable Acidity' are frequently used as though they were completely synonymous However, from a laboratory standpoint, they are different. Titratable Acidity refers to the amount of acid in a product determined by measuring how much alkali needs to be added to neutralize the acid (where the neutral condition is chosen as a somewhat arbitrary value of pH) and then expressing the result in terms of just one of the acids present in the food. Total Acidity, on the other hand, refers to the actual sum of all the acids present in the product. To compound the situation further, tests for wine TA produce different or different-looking results when:

Some countries choose to calculate TA as though all the acid measured had been sulfuric acid, while others express TA as though it had all been tartaric acid.

Different amounts of alkali will be used to reach the endpoint in each instance (for the same wine), the TA value reported in each case will be different. For practical reasons, since wine acids are weak organic acids, titrating with a strong alkali should result in a true pH end point in the range of 7.8 and 8.3 (Ough & Amerine, 1988, p. 51); therefore an endpoint at pH 8.2 is theoretically more correct in that it more truly represents the amount of acids present.

Some countries express TA using different units.

TA may be expressed in units of grams per liter (g/L) tartaric acid, grams of sulfuric acid per liter, grams per 100 mL (g/100 mL), milligrams per liter (mg/L) either as tartaric or sulfuric acid, depending on the country. An alternative mode of expression, independent of the acids present in the wine, is to use milliequivalents per liter (meq/L). Such differences in expressing TA lead to potential confusion among those engaged in wine trade.

POTENTIAL SOLUTION

The working group has evaluated all these considerations with respect to existing national and regional regulations for wine. From a scientific standpoint, in order to facilitate trade in wine and reduce technical barriers, the following approach seems to have merit. When it is decided that reporting of TA is required, it

would be most appropriately expressed in terms of *tartaric* acid since this is a major, naturally occurring acid in grape wine. The most appropriate endpoint for the titration would seem to be at a pH of 8.2 (using phenolphthalein as indicator or a correctly calibrated pH probe). This approach would conform to current practices described in the literature (Amerine et al., 1980; OMA, 1990). Finally, reporting TA in terms of g/L provides a standardized format in SI units, as agreed by attending parties at the 2015 International Wine Technical Summit.

CONCLUSION

Since tartaric acid is the primary acid component in grape wine, reporting TA in terms of tartaric acid provides a more meaningful value. The use of a titration endpoint at a pH of 8.2 and reporting the results in terms of g/L tartaric acid provides ease of interpretation of data ensuring less scope for confusion among countries engaged in wine trade.

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APPENDIX A: PRINCPLE 6. LIST OF WINE CONSTITUENTS EXPRESSED IN VARYING TERMS

	27CFR (unless indicated otherwise)		OIV		Potential Confusing Factor
Constituent	**Section(§)**	**Expressed as**	**Section(§)**	**Expressed as**	
Alcohol Proof	4.20 24.10	Ethyl alcohol distilled at or above 190 proof Ethyl alcohol content of a liquid at 60 degrees Fahrenheit…		Potential alcohol/total alcohol/actual alcohol	
Brix	24.10	"…grams of sucrose in 100 grams of solution at 68F (20C) (Percent by weight of sugar)			
Boron				Boric acid	
Calcium sulfate (for use in sherry)	24.246	Potassium sulfate			
Copper sulfate	24.246/24.247	Copper			
Fixed acidity	24.182	Tartaric acid	Fixed acidity OIV-MA-AS313-01:R2009	Grams of sulfuric acid per liter (or) grams of tartaric acid per liter	Tartaric vs sulfuric expressed as meq/L, g/L, g/100 mL
Pure dry sugar	24.10	Refined sugar 95 percent or more by weight dry, having a dextrose equivalent of not less than 95 percent on a dry basis, produced from cane, beets, or fruit, or from grain			

		or other sources of starch			
Sugar	4.20 _____ 24.10	Pure cane, beet, or dextrose sugar in dry for containing, respectively, not less than 95 percent of actual sugar calculated on a dry basis _____ Pure dry sugar, liquid sugar, and invert sugar syrup			
Residual sugars (RS)					Reducing sugars vs residual sugars vs reducing substances- need definition
Sugars	21§101.9(B)(ii)	Sum of all free mono- and disaccharides (such as glucose, fructose, lactose, and sucrose)			
Sulfur dioxide/sulfites	4.22(b)(1)	Sulfur dioxide			
Sulfates			Sulfates OIV-MA-AS321-05A:R2009	…*potassium sulfate*, K2SO4	
Tannin	24.246	Gallic acid equivalents (GAE)			
Tartaric acid	24.184	Tartaric acid in grams per liter	Tartaric acid	The quantity of tartaric acid per	Tartaric vs potassium

			OIV-MA-AS313-05A:R2009	liter of wine, expressed in grams of tartaric acid (or) the quantity of tartaric acid per liter of wine, expressed in grams of *potassium tartrate*	tartrate, meq/L, g/L
Titratable acidity (TA)	24.182	Tartaric acid	Total acidity OIV-MA-AS313-02:R2009	The total acidity expressed in grams of tartaric acid per liter (or) the total acidity expressed in grams of *sulfuric acid* per liter	Tartaric acid vs sulfuric acid expressed as meq/L, g/L, g/100mL sulfuric or tartaric, pH
Total phosphorous			OIV-MA-AS321-04:R2009	The total phosphorous content expressed… of phosphoric anhydride, P2O5	
Volatile acidity	4.21(a)(1)(iv)	Acetic acid	Volatile acidity OIV-MA_AS313-02:R2009	The volatile acidity, expressed in grams of *sulfuric acid* per liter (or) the volatile acidity, expressed in grams of acetic acid per liter	Acetic acid vs sulfuric acid, meq/L, g/L