



A comparison study of total acidity methods for the analysis of wine

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Goal

To compare total acidity analysis
methods for wine and other alcoholic
beverages

Introduction

Results obtained from the analytical techniques used for evaluating wine, liqueur, and cider during the production process are important for alcoholic beverage making. There will be a difference in the results reported depending upon the analytical procedure used. In Europe, total acidity in musts and wines is defined by the Office International de la Vigne et du Vin (OIV) as the sum of titratable acids up to pH 7.0 using a NaOH solution. Neither carbonic acid nor sulfur dioxide are included in the expression of total acidity. In the United States, the Association of Official Analytical Chemists (AOAC) has established a pH of 8.2 using a titration indicator with phenolphthalein as the end point. Total acidity is usually expressed as grams of tartaric acid per liter.

There is sometimes confusion with terminology because titratable acidity (TA) and total acidity are often used interchangeably. Total acid content is defined as the concentration of organic acids in grapes and wine whereas TA is a measure of the hydrogen ions consumed by titration with a standard base up to a defined end point.

Wine samples measured with the Thermo Scientific™ Total Acids method are compared in this study to results from the traditional titration method. In Europe, wine samples are often analyzed using the OIV Total Acidity method, an automated titration with a bromothymol blue indicator. The intention of the method reported here is to improve the total acidity measurement in the wine laboratory by introducing an automated colorimetric version of the OIV method. In this report, results from the OIV Total Acidity Type 1 method (OIV-MA-AS313-01) and an automated Total Acids method are compared.

Experimental

Materials and methods

The OIV Total Acidity method uses a potentiometric titration or titration with bromothymol blue as an indicator and compares the result with an end point color standard.

In the Thermo Scientific™ Total Acids method, a bromothymol blue indicator changes color from yellow to blue when the pH changes from 6.0 to 7.6. The sample is added to a buffer solution and measured with the color reagent. Change in the blue color is measured at a wavelength of 620 nm with the side wavelength of 700 or 750 nm. The purpose of measuring a side wavelength is to remove the effect of bubbles that may appear in cuvettes. The side wavelength is determined from the spectrum area where no reaction occurs. Results are calculated automatically by the analyzer using a calibration curve. This test determines total acidity within a measuring range from 1.0 to 18.0 g/L expressed as tartaric acid and from 0.5 to 12 g/L expressed as sulfuric acid.

Samples and sample pretreatment process

In this study, white wine, red wine, spiced white wine (mulled wine, glög), spiced red wine, cider, and liqueur samples in concentrations ranging from 2.65 to 8.82 g/L (calculated as tartaric acid) were analyzed. Samples were run without pretreatment or predilution steps.

Instrument and reagent kit

The Thermo Scientific™ Gallery™ discrete analyzer was used for automated photometric determination.

A Thermo Scientific Total Acids (Wine, pH 7) system kit was used for colorimetric analysis of total acidity. In addition, a self made tartaric acid (Sigma-Aldrich 251380) solution was used for calibration and standards were diluted automatically by the analyzer.

Results and discussion

Results from the method correlation study are shown in Table 1. The same samples were analyzed using the two different methods. In the Recovery column, results from the automated Total Acids method were compared with the OIV method. Good recoveries ranging from 91 to 112% were shown. Based on the sample type (color or acidity), no trend was noticed with this set of samples. As a result, the automated colorimetric method can be used for all the sample types tested because the colorimetric method correlated very well with the titration method.

One major advantage of the automated Total Acids method was speed. It took less than 18 minutes to analyze 26 samples. An added benefit is that the method requires no sophisticated skill set or additional hands-on analysis time. For example, a five point calibration with automated dilution was complete in 2 min 30 seconds without any extra effort from the analyst.

Colorimetric determination of Total Acids provides a rapid, user-friendly way of analyzing total acidity from alcoholic beverages such as white wine, red wine, cider, and liqueur. Along with the Total Acids method, other colorimetric or enzymatic methods, for example, glucose, fructose, acetaldehyde, total polyphenol, calcium, sulfur dioxide, can be run simultaneously on the analyzer.

Table 1. Results of a correlation study between the Thermo Scientific Total Acids (Wine, pH 7) and OIV wine Total Acidity methods

Sample	Result from Automated Thermo Scientific Total Acids Method (g/L)	Response (Absorbance)	Average (g/L)	Results from OIV Reference Method (g/L)	Bias	Recovery (%)
White spiced wine	2.62	0.2435		2.65	-0.035	99
White spiced wine	2.66	0.2424	2.65	2.65	0.012	100
White spiced wine	2.67	0.2422		2.65	0.020	101
White wine 1	7.18	0.1457		7.86	-0.676	91
White wine 1	7.17	0.1460	7.18	7.86	-0.691	91
White wine 1	7.19	0.1457		7.86	-0.675	91
White wine 2	5.68	0.1778		5.44	0.240	104
White wine 2	5.69	0.1777	5.67	5.44	0.248	105
White wine 2	5.63	0.1789		5.44	0.187	103
White wine 3	5.53	0.1809		5.52	0.008	100
White wine 3	5.53	0.1809	5.54	5.52	0.012	100
White wine 3	5.56	0.1803		5.52	0.042	101
Cider 1	5.23	0.1869		4.91	0.324	107
Cider 1	5.24	0.1868	5.24	4.91	0.332	107
Cider 1	5.23	0.1870		4.91	0.319	106
Cider 2	6.00	0.1713		5.84	0.155	103
Cider 2	5.98	0.1717	5.98	5.84	0.138	102
Cider 2	5.97	0.1718		5.84	0.130	102
White wine 4	7.34	0.1423		7.31	0.033	100
White wine 4	7.34	0.1423	7.35	7.31	0.033	100
White wine 4	7.36	0.1419		7.31	0.051	101
Red spiced wine	5.94	0.1725		5.34	0.598	111
Red spiced wine	5.92	0.1730	5.94	5.34	0.576	111
Red spiced wine	5.97	0.1718		5.34	0.631	112
Liqueur	8.56	0.1166		8.82	-0.258	97
Liqueur	8.51	0.1175	8.52	8.82	-0.305	97
Liqueur	8.49	0.1180		8.82	-0.330	96

References

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Compendium of International Methods of Analysis, Wine and Must, Method OIV-MA-AS313-01:R2003.

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