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Automated Tartaric Acid Analysis in Wine Using a Discrete Analyzer

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INTRODUCTION

Acids in the right combination provide wine with their crisp, slightly tart taste. If a wine is too low in acid, it tastes flat and dull; too high in acid and it is tart and sour. Tartaric acid, not found in most other fruit, is the primary acid in the grape and thus controls the acidity of a wine. It plays a critical role in the taste, feel, and color of wine. More importantly, it lowers the pH to a level that improves resistance to bacterial contamination, acting as a preservative. Tartaric acid deficiency therefore, can contribute to various wine issues.

The purpose of this study was to evaluate the determination of tartaric acid in red wines using Thermo Scientific™ Gallery™ automated discrete analyzer. Tartaric acid method is based on formation of a complex between tartrate and vanadate. There is no need for pretreatment of red wine samples since the red color is removed by hypochlorite during the automated procedure.

The evaluated red wine method correlated well (y = 0.9627x + 0.235, R^2 = 0.9304) with flow injection analysis (FIA) method.

MATERIALS AND METHODS

Reagents

Ready to use Thermo Scientific system reagents, ordering code 984309, were used. Reagent kit contains two reagents required for the method and a calibration standard. Additionally Hypochlorite reagent, 984030 was used in the automated sample color removal procedure and 981712 Wash Fluid for automated washing. Bar-coded reagents are automatically identified by the analyzer software.

Sample Preparation

Color from red wine samples is removed by Hypochlorite during the automated procedure. No additional sample preparation is required.

Instrument

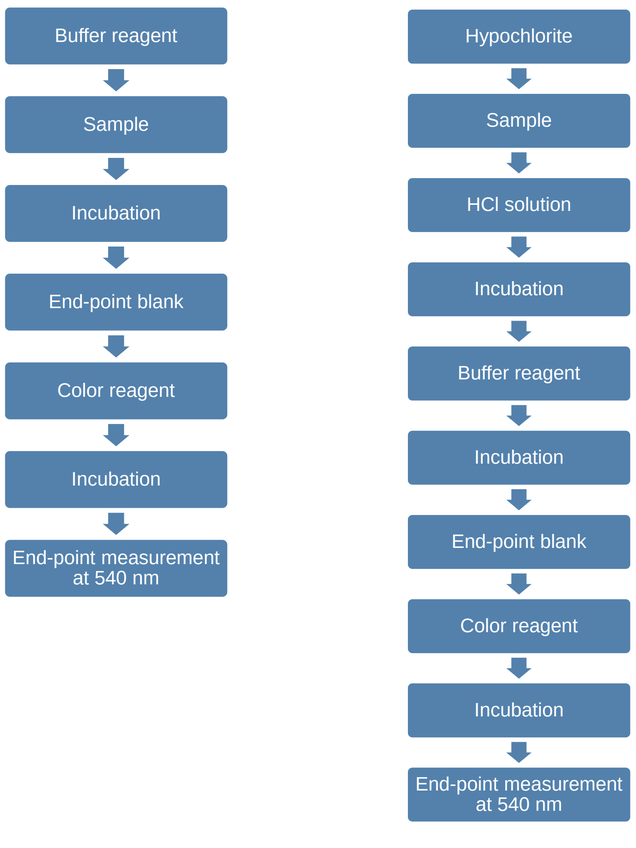
Analysis was performed using Gallery discrete photometric analyzer where all analysis steps are fully automated, such as sample and reagent dispensings, mixing, incubation and photometric reading at the selected wavelength. The instrument is capable of performing multiple parameters simultaneously without any method changeover time or system priming. Samples with Tartaric acid levels outside the calibration range are automatically reanalyzed with a dilution. Each measurement is carried out in a disposable Decacell™ cuvette which eliminates possible carry-over between samples.
For the method comparison studies a flow injection analyzer (FIA) was used.

Figure 1. Gallery (left) and Gallery Plus (right) discrete photometric analyzer

Method Principle

The Tartaric acid method, used on the Gallery analyzer is based on formation of a complex between Tartrate and Vanadate. Readings are performed at 37 ºC and the color of the formed complex is measured at the wavelength 540 nm. There is no need for pretreatment of red wine samples since the red color is removed by hypochlorite during the automated procedure. Total analysis time for one sample is less than 10 minute.

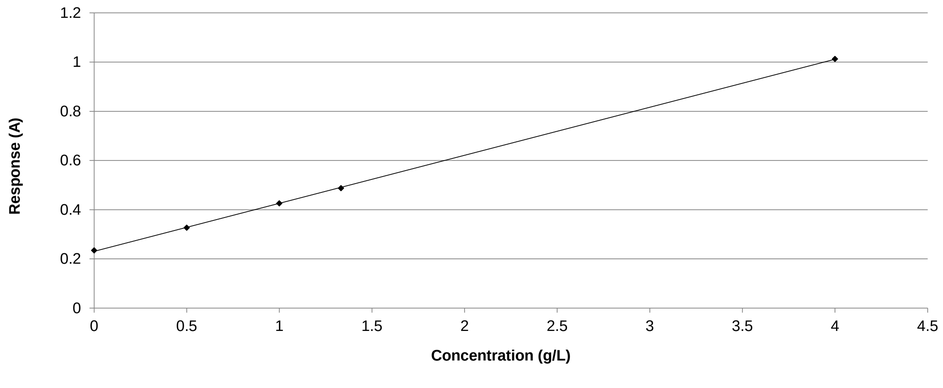
Figure 2. Gallery method protocol for white wines (left) and red wines (right)



Calibration

Calibration was performed using a standard included in the reagent kit. The concentration of the standard is 4 g/L. The calibration points were automatically diluted by the analyzer.

Figure 3. Calibration example of the Gallery red wine application

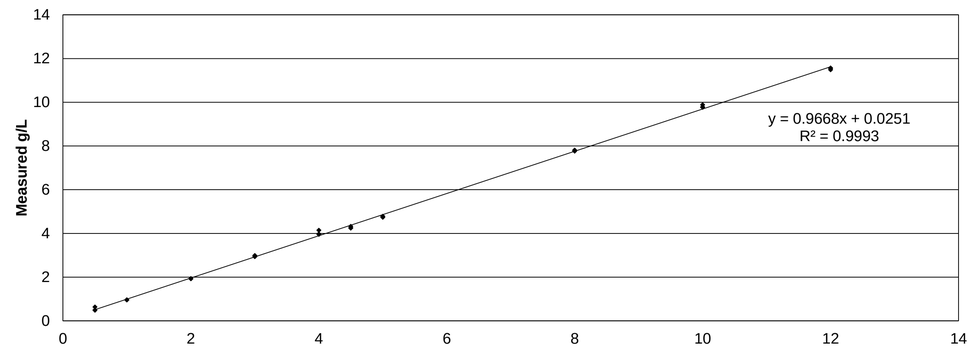


Results

Linearity

Method linearity was tested with pure chemicals dissolved in deionized water. The linearity was optimized to cover a typical sample range from 0.5 g/L to 12 g/L. Samples with tartaric acid concentrations above the calibration range >4 g/L are diluted to 1:3 with the automatic dilution feature. Each standard was measured as triplicates.

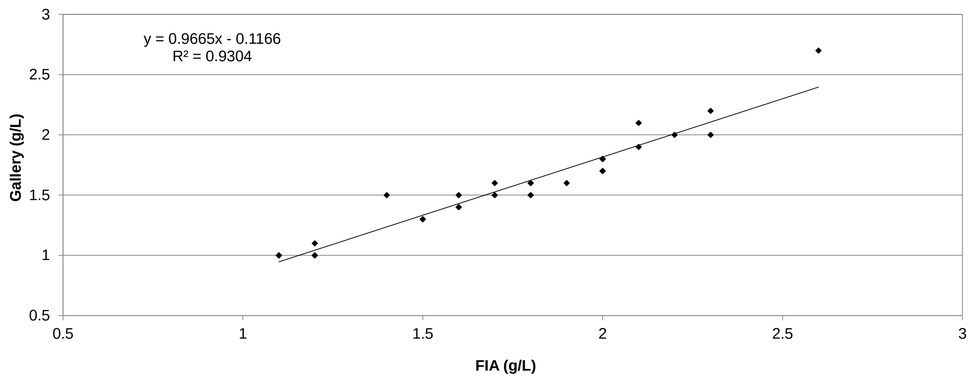
Figure 4. Linearity of the method in the range of 0.5-12 g/L



Method comparison

For the method comparison study, 33 red wine samples were analyzed. Results were compared against the FIA method. Recovery rates varied between 83-107 %, which shows good correlation between the two methods.

Figure 5. Method comparison against flow injection analyzer



Repeatability

A repeatability study was performed by analyzing both white and red wine samples with the Gallery analyzer in three batches, 10 replicates in each batch with a total number of n=30 for each sample. The test was calibrated at the beginning of each batch and the method repeatability data is shown in Table 1.

Table 1. Repeatability of white wine and red wine samples

	White wine		Red wine	
	N	30	N	30
	Mean	2.76	Mean	2.11
	SD	CV %	SD	CV %
Within run	0.045	1.6 %	0.052	2.5 %
Between run	0.043	1.5 %	0.042	2.0 %
Total	0.062	2.2 %	0.067	3.2 %

CONCLUSIONS

This study shows that the Gallery tartaric acid method is a precise and accurate method suitable for monitoring tartaric acid concentrations in wine. Analyzing red wine sample is typically challenging due to the strong sample color. However, the Gallery method automatically removes sample color interference, saving hands-on time as no pretreatment is needed.

In addition, the automated Gallery discrete analyzer is capable of simultaneously analyze from a single sample other important wine and must parameters, for example sugars, other acids and yeast available nitrogen.

TRADEMARKS/LICENSING

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