SENTIA

Test performance of the Sentia free SO$_2$ Wine Analyzer.

Comparable to established laboratory and winery methods.

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INTRODUCTION

Small, medium and large-scale winery operations use different methods in determining free SO_2 in wine samples. Many of these tests use industry accepted methods such as Aeration Oxidation. The Aeration Oxidation method relies on a transfer of unbound sulfur dioxide from the wine through an airstream to a capture vessel where the SO_2 is fixated by oxidation with hydrogen peroxide. The Sentia free SO_2 Wine Analyzer is a hand-held device for rapid on the spot results for free SO_2 from a single drop of wine.

This external validation study[1], conducted as per CLSI EP09-A3 guidelines[2], assessed the Sentia free SO_2 Analyzer against an established laboratory method (Aeration Oxidation – A/O Method).

SUMMARY

Method comparison between the Sentia free SO_2 Analyzer and the A/O method demonstrated good correlation (r^2=0.91). Standard error was 4.3 mg/L.

Repeatability for red wine was 2.0% (CV) and for white wine it was 1.8% (CV) and was found to be well within laboratory industry standard acceptance precision.

The data and subsequent analysis validate the intended use of the Sentia free SO_2 Analyzer for on-the-spot testing and monitoring of red and white wine samples.

LABORATORY/ WINERY UTILITY

The Sentia free SO_2 Analyzer is intended for in-winery testing of free SO_2 in wine samples by personnel without requirement for specialist skills or need for sample collect and return. It is an reliable, convenient, easy-to-use handheld instrument with enhanced features designed to assist operators during the testing process:

- Fast results (less than a minute) across the 3- 50 mg/L reporting range
- Small, 8 µL sample size
- Push-button ejection of used test strips to minimize user interaction
- No need for any reagent pre-mixing – just apply the wine sample and go
- Easy-to-use colour touchscreen interface and clear display of results as mg/L or ppm units
- Integrated strip lot identification to facilitate rapid, error-free calibration data capture (calibration free system)
- Seamless, secure data download via WiFi connection

TECHNOLOGY

The Sentia System which includes the Analyzer and the consumable test strip have been designed and developed using Universal Biosensors' pedigree of medical device expertise. The analyzer uses the same platform as Universal Biosensors' other medical devices and the test strip is manufactured on the same equipment used to manufacture other medical device consumable products. This allows Sentia to deliver a testing solution that is on par with any of its other previous products delivered in the medical device field.

Unlike glucose and fructose enzymatic tests, the free SO_2 strip uses voltammetry instead of amperometry, which in this case means observing electrical current as a function of voltage rather than time - specifically, square wave voltammetry. When wine is added to the strip, it dissolves dried down reagents on the strip. The dried down acid automatically adjusts the pH of the sample so that the hydrogen sulphite gets converted to sulphur dioxide. This becomes directly reduced at the electrode when the square wave waveform is applied. The data obtained is analysed to generate "differential current vs voltage" data which contains a peak around 600 mV. The height of this peak correlates to the concentration of sulphur dioxide in the wine sample.

STUDY PURPOSE

The free SO_2 test on the Sentia Analyzer must demonstrate sufficient performance against the laboratory reference method to be complementary in the context of a winery setting.

The results—in terms of precision and low bias—facilitate optimal use of the analyzer for decision making purposes.

The study investigated:

- Agreement versus a proven reference laboratory method used for free SO_2 testing and reporting (accuracy)
- Repeatability (precision)

METHODS

Method Comparison

107 wines comprising 51 red wines and 56 white wines were tested as part of this study. Any varietal was capped at a maximum of 10 to not overly skew the data in any one way. At the external site [1] a wine sample was tested on a Sentia Analyzer and simultaneously tested on the reference method (Aeration Oxidation). Subsequent data analysis was performed by Universal Biosensors Pty Ltd (Rowville, Victoria, Australia).

Repeatability

1 red and 1 white wine from the same lot were tested as per CLSI EP05-A3 guidelines[3] to assess variation within the Sentia System. Three different test strips lots were tested for 5 days with 2 runs per day.

The above study was conducted using test strips and analyzers manufactured on validated lines.

RESULTS

Method Comparison

Figure 1 shows a plot of the Weighted Linear Least Squares regression performed on free SO_2 results from the mean Sentia result compared to the mean free SO_2 result from the reference Aeration Oxidation Method.

Table 1 presents method comparison regression statistics and calculated bias.
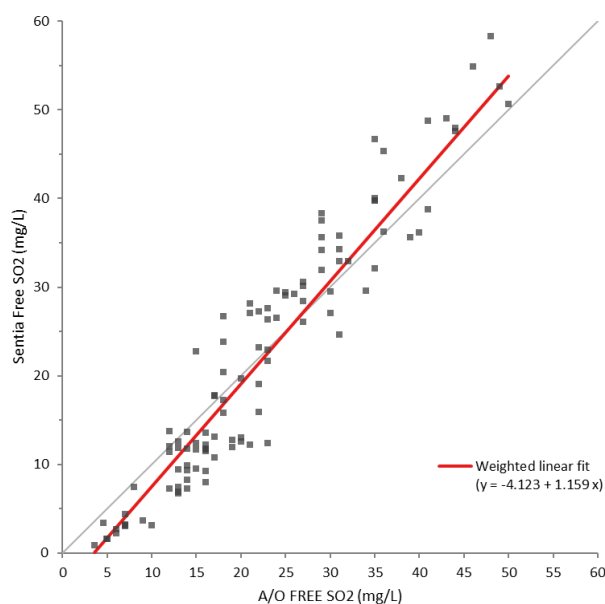
Figure 1 - Plot of Weighted Linear Least Squares Regression Fit (Red) and line of Identity (Grey)

This study demonstrated good correlation (r^2=0.91) of the Sentia free SO_2 Analyser with the reference laboratory Aeration Oxidation Method. The study also showed a standard error of 4.3 mg/L.

Table 1 – Sentia Analyzer versus Aeration Oxidation method comparison regression statistics and bias based on mean values

Slope (95% CI)	Intercept (95% CI)	Correlation Coefficient (r)	Coefficient of Determination (r^2)	Standard error (mg/L)
1.159 (1.087, 1.230)	-4.123 (-5.057, -3.189)	0.955	0.91	4.3

REPEATABILITY

Table 2 – Sentia free SO_2 performance for a red and white wine reproducibility study (CLSI EP05-A3 5 Day Study).

Wine Type	Mean (mg/L)	Repeatability CV	Repeatability SD
Red	16.86	2.0%	0.33
White	30.48	1.8%	0.54

Data analysis demonstrates excellent precision with repeatability CVs of 2.0% and 1.8% for red and white wine respectively.

DISCUSSION AND CONCLUSION

The Sentia Analyzer was validated according to its intended use with wine samples. Over the measuring range, the following Weighted Linear Least Squares regression results were presented:

- Slope: 1.159 (95% CI 1.087 to 1.230)

- Intercept: -4.12 (95% CI -5.06 to -3.19)

- Coefficient of determination (r2) ≥0.91

Standard error was 4.3 mg/L. Test repeatability was ≤2.0% CV, well below the criterion of acceptance.

Winery personnel can confidently use the test at the point-of-use to monitor free SO_2 concentrations in wine samples.The reliable, lab-quality performance of the Sentia Analyzer is complemented by its speed, simplicity, efficiency, and overall practicality in point-of-use settings.

References

(1)   AWRI - The Australian Wine Research Institute, Waite Precinct, Hartley Grove cnr Paratoo Road, Urrbrae (Adelaide) SA 5064

(2)   CLSI EP09-A3 Measurement Procedure Comparison and Bias Estimation Using Patient Samples, 3rd Edition (Clinical and Laboratory Standards Institute)

(3)   CLSI EP05-A3 Evaluation of Precision of Quantitative Measurement Procedures, 3rd Edition (Clinical and Laboratory Standards Institute)

UNIVERSAL BIOSENSORS

Universal Biosensors (UBI) began its journey focusing on the research, development and manufacture of devices for the diagnostic point of care (POC) market using UBI's core technology of a disposable, multi-layer test strip, which incorporates a proprietary electrochemical sensing system that rapidly and accurately measures different biomarkers in blood.

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