

Wine testing and analysis

J. Richard Sportsman, Ph.D.

Vinmetrica



Today's talk

- Vinmetrica and me
- Wine pH and TA
- Controlling SO₂
- New tools for better guidance



Vinmetrica

- Started 2010
 - Preceded by 16 years of amateur winemaking
 - Need for better SO₂ analysis
- Developed the SC-100 system for SO₂
- Wine lab tools that are
 - Easy
 - Accurate
 - Affordable



Vinmetrica Today

- Over 6000 analyzers in use worldwide
- Instrument kits for SO_2 , pH & TA, Malic acid
- Test systems for RS, YAN, DO & %ABV
- Lab Services
 - Wine chemistry
 - Microbiology



Rich Sportsman

- Ph.D. analytical chemistry U Arizona 1982
- Bay area biotech 1992 - 2008
- Amateur winemaker since 1993
- Started Vinmetrica 2010
 - Commercialize my sulfite toy
- Started Little Oaks Winery 2012
 - Hobby out of control



Measuring pH

- Don't stir or swirl solution continuously
 - Mix briefly and then let the electrode sit still
 - Former recommended stirring not needed with new electrodes
- Calibrate system daily
 - Set with 4.01 (or 3.00) and 7.00 reference solutions
 - Best to have everything at same temperature
 - Tip: check with Cream of Tartar
 - AKA potassium hydrogen tartrate or bitartrate
 - Fresh saturated solution ($\frac{1}{4}$ tsp/20 mL H_2O) gives pH 3.55 at 25°C
- Take pH reading.
 - Don't add water!



Measuring TA

- Take measured sample (5 mL)
 - remove CO₂ by shaking or vacuum, if needed
 - Musts: homogenize first?
 - reds probably yes
 - whites probably no
 - Add water as needed
- Titrate with 0.10-0.20 M NaOH to pH 8.2 (7.0?)
- Reported as g/L or g/100 mL (%) tartaric acid

Measuring Sulfite (SO₂)

- Critical sulfite levels in winemaking
 - Before primary
 - After primary before MLF inoculation
 - Monthly during barrel aging
 - At bottling
- Methods
 - Ripper titration
 - Aeration Oxidation (Monier-Williams)

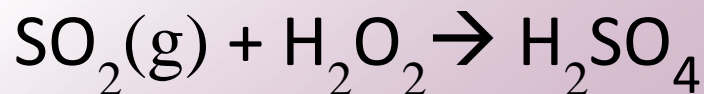
Measuring Sulfite (SO₂)

- “Ripper titration”: reaction of SO₂ and iodine



Endpoint iodine detected by starch (blue color) or electrode (Hanna, Vinmetrica).

- Aeration Oxidation (AO)



Air bubbled through acidified wine sweeps SO₂ into peroxide.

Resulting sulfuric acid is titrated at the end with NaOH.

- What is the most reliable method?

Comparison of SO₂ methods

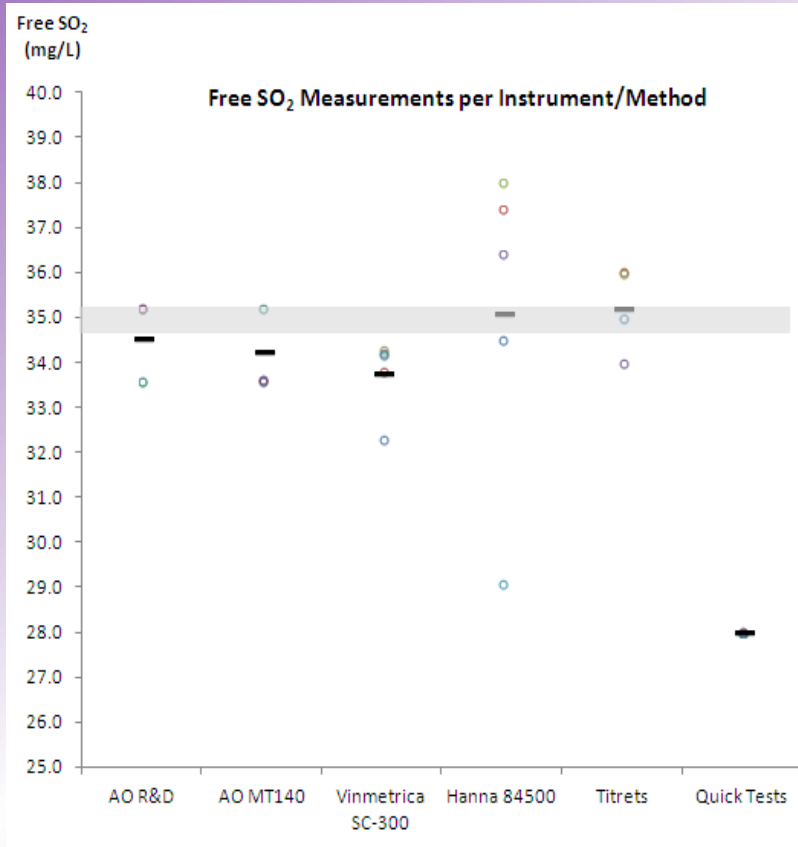


Figure 1. Free SO₂ on 35 mg/L

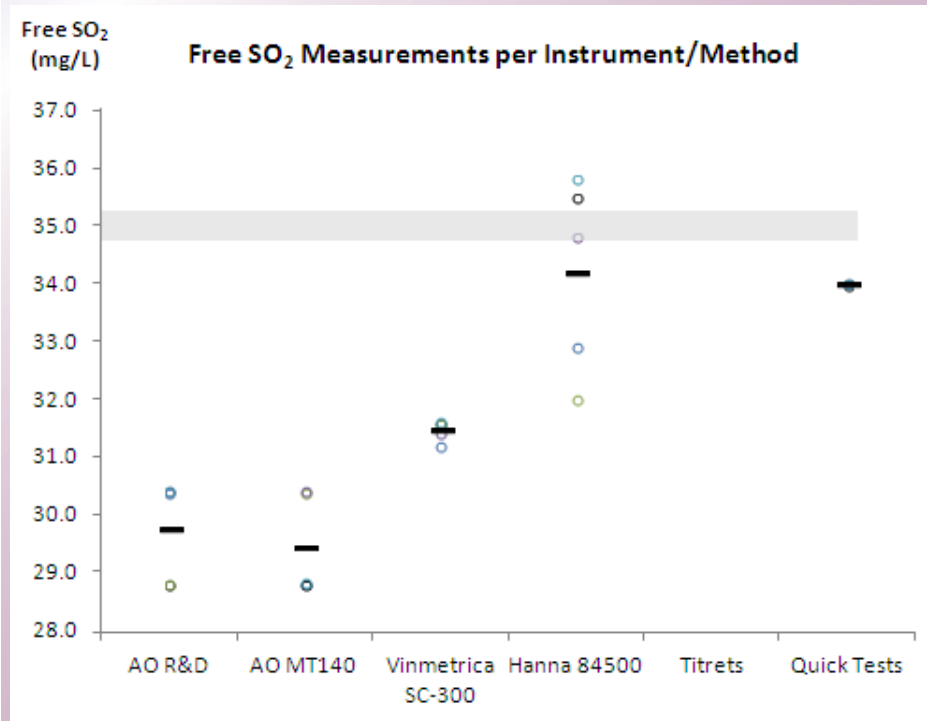


Figure 3. Free SO₂ on 35 mg/L with grape tannins, 2 g/L

Price/performance for SO₂

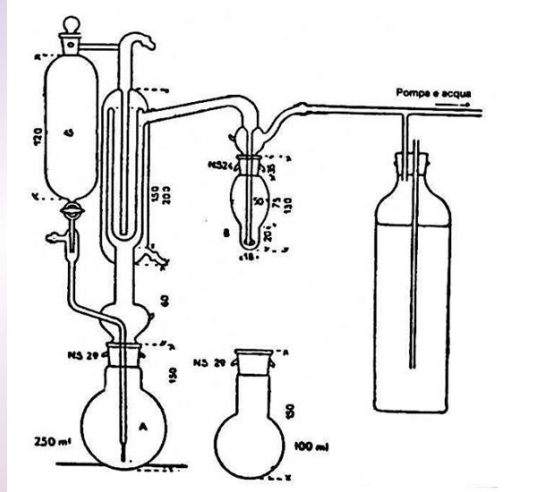


Hanna autotitrator

\$900

2 min

Ripper titration/ORP

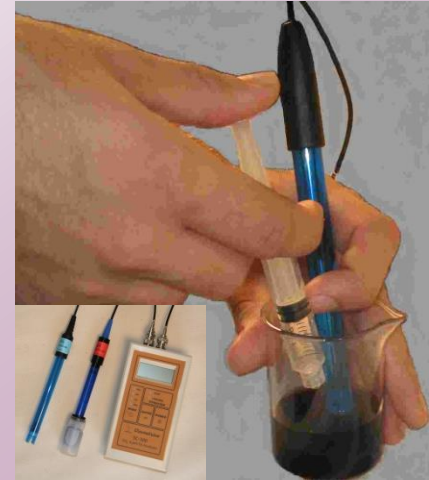


Aeration Oxidation Setup

\$200

20 min

Aeration-H₂O₂ oxidation/ NaOH titration



Vinmetrica SC-300 (+ pH & TA)

\$485

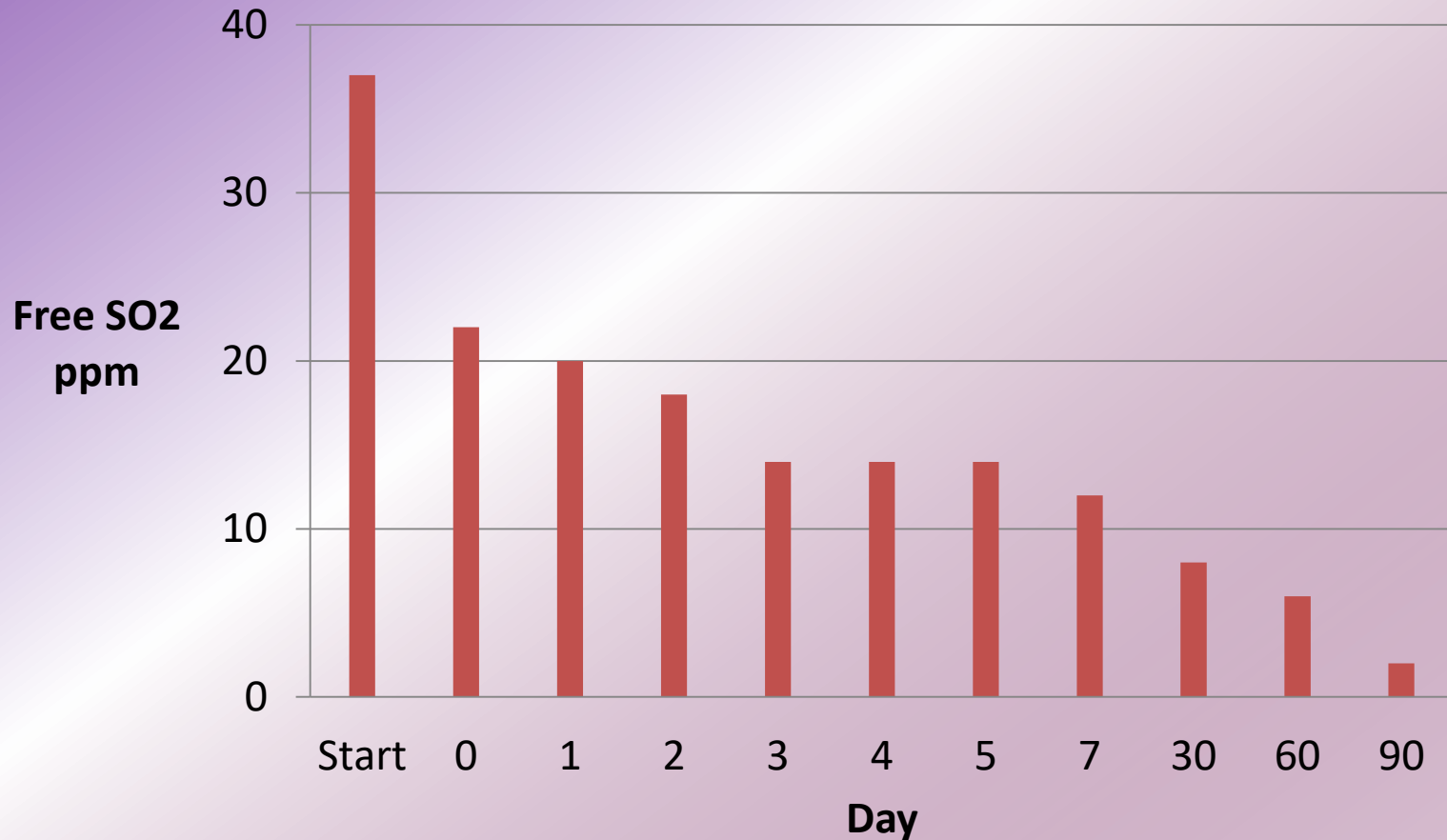
2 min

Ripper titration/Ampero



Vinmetrica

Free SO2 levels drop!



D. Pambianchi, 2014

“A Review of Sulfite Management Protocols Based on SO2 Levels and Type of Wine” https://morewinemaking.com/web_files/morebeer.com/files/SO2_Management_Protocol.pdf

Adjusting SO₂

- Potassium metabisulfite 10% solution
- SO₂ gas or liquid
- Target levels depend on pH and desired “molecular SO₂” target (0.5 to 0.8 ppm)
 - 20-40 ppm free SO₂ typical
- Use sulfite calculators (e.g. WMM's or FermCalc)
- Freshly-added SO₂ should be re-checked
 - Loss due to binding or dO₂ over a few hours

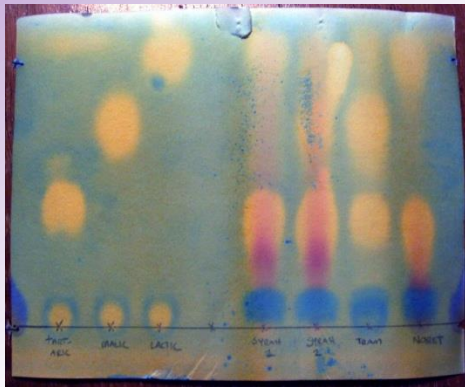
New Tools

- Malic acid testing for MLF completion
- dO₂ electrode
- ABV analysis
- Sentia™ Analyzer



Malic methods

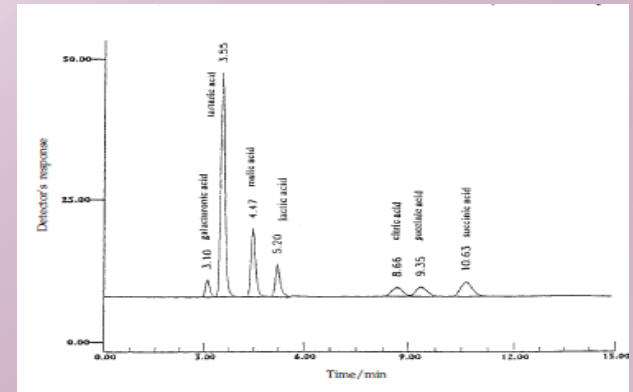
- Need to know when MLF is done for timely SO₂ adjustment
- Measure malic acid levels.
- Want < 0.1 g/L



Paper chromatography
24 hours – qualitative
Inexpensive, simple
Detects 0.2 g/L



Enzymatic - photometry
1 hour - quantitative
Expensive, technical
Detects 0.01 g/L



HPLC
<1 hour - quantitative
very expensive & technical
Detects 0.01 g/L

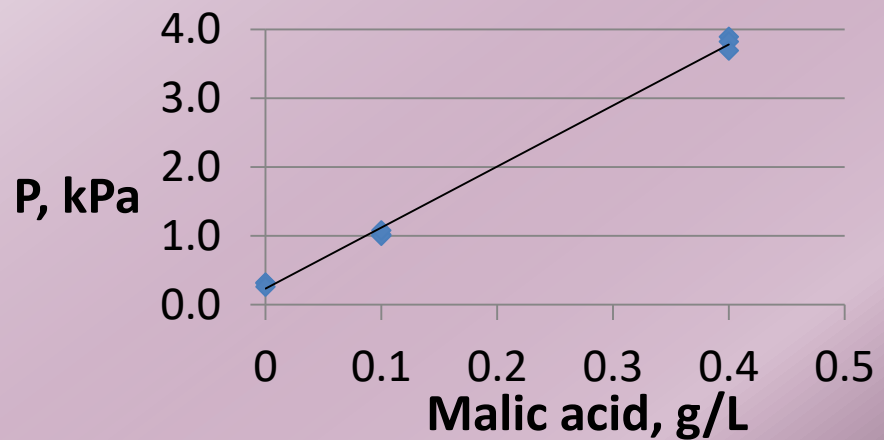
Malic Methods



Accuvin Malic Acid
Quick Test™



Vinmetrica
SC-50 MLF Kit



Dissolved Oxygen System

- Managing O₂ levels in must and wine is critical.
- dO₂ electrode: dip and read
- Target < 2 mg DO/L @ bottling.



Test	mV	“pH”
0% DO	+8.0	6.67
100% DO	+302	1.48
Wine sample	+50	5.92

$$\text{DO, \% saturation} = 100 * (50 - 8.0) / (302 - 8.0) = 14\%$$

Or

$$= 100 * (5.92 - 6.67) / (1.48 - 6.67) = 14\%.$$

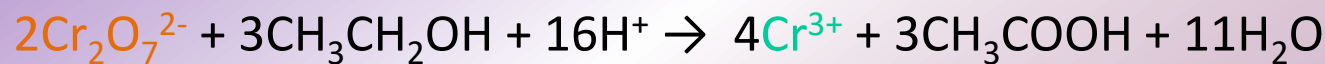
Saturating oxygen at RT and pressure is ~8.5 mg/L
=> 8.5 mg/L x 14% = 1.2 mg/L

Alcohol by Volume

- Current accurate methods are expensive:
 - FT-IR based systems
 - Gas chromatography
 - Ebulliometry
 - Distillation followed by titration or other
- Inaccurate methods
 - Difference in RI or SG
 - Bioassay

ABV assay

- Ethanol in the sample volatilizes into the reaction chamber
- Diffuses into and reacts with the Oxidant underneath.

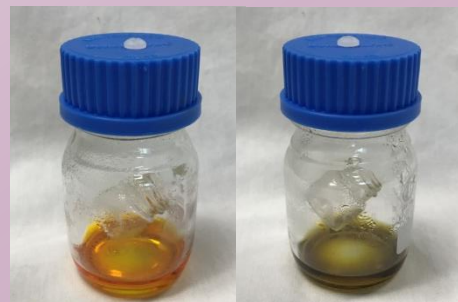


Orange

blue-green

Oxidation of ethanol to acetic acid by dichromate (Oxidant)

- Non volatile components not detected
- Accurate, simple titration for wine, beer, spirits
- 4-24 hour incubation



The ABV Reaction

ABV: Quick titration, and done



Convert leftover dichromate to iodine (Developer)



Titrate the iodine with thiosulfate (ABV Titrant)

- Accurate to within 0.3% ABV
 - for wines and beers; 0.5% in spirits
- Cost per test ~ \$3.00



SENTIA™ Wine Analyzer

- Free SO₂, Malic Acid, RS results in less than a minute
- Handheld size, 1 drop sample
- Upload results and update system via Wi-Fi
- Touchscreen display - easy and intuitive
- Over 100 tests on a single charge
- Reproducible results, comparable to other methods
- No calibration needed
- Only \$3.50 per test



Sentia Free SO₂ compared with Vinmetrica

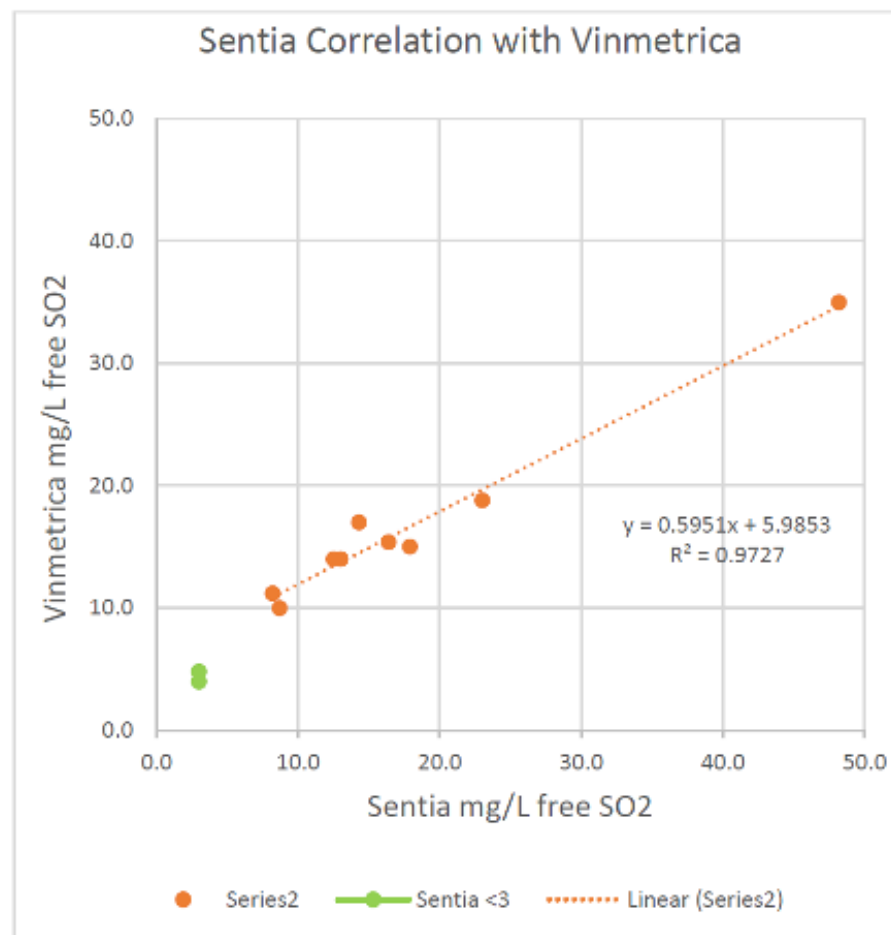
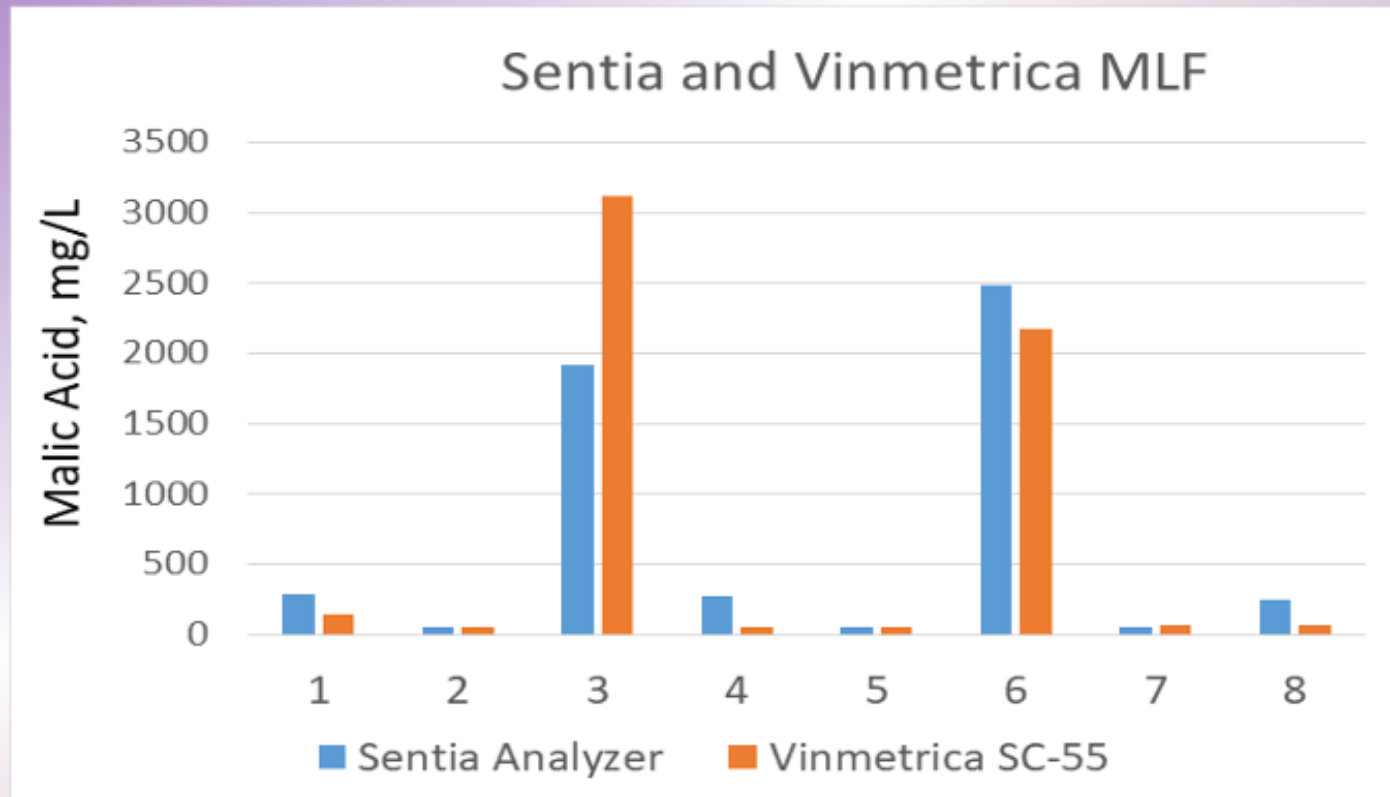


Figure 1. Correlation of Sentia and Vinmetrica results on the wines listed in Table 1.



Vinmetrica

Sentia Correlation with Vinmetrica: Malic Acid



Eight wine samples (2 white, 6 red) were analyzed on the Sentia Analyzer and on the Vinmetrica SC-55. Samples 2, 5, and 7 were just at, or below, minimum detectable concentration (50 mg/L) by both methods.



Vinmetrica

Summary

- Vinmetrica: Fast, inexpensive and accurate tests
 - Service and Support
 - Wine analysis services also
- Control sulfite and acidity with quick feedback
- Sentia analyzer for SO₂, MLF, RS
 - Rapid, simple, test-in-place
 - TA, VA in development

