Controlling sulfite (SO$_2$) in your winemaking

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Vinmetrica
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Vinmetrica

• Started 2010
  – Preceded by 16 years of amateur winemaking
  – Need for better SO$_2$ analysis

• Developed the SC-100 system for SO$_2$

• Wine lab tools that are
  – Easy
  – Accurate
  – Affordable
Vinmetrica Today

- Over 8000 analyzers in use worldwide
- Instrument kits for SO₂, 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
- SF Bay area biotech 1992 - 2008
- Amateur winemaker since 1993
- Started Vinmetrica 2010
- Started Little Oaks Winery 2012
Wine and SO$_2$

• Most important parameter to control
  – Low levels: oxidation and bad microorganisms
    • Browning, sherry/solvent odors, high VA
  – High levels: stuck fermentation, bitterness

• Easy to measure and adjust
  – SO$_2$ as ppm or mg/L: these are equivalent

• Worth the effort
Molecular SO$_2$, Acidity, and Sulfite
It’s the *molecular* that counts!

\[
\text{SO}_2\cdot\text{H}_2\text{O} \leftrightarrow \text{H}^+ + \text{HSO}_3^- \leftrightarrow 2\text{H}^+ + \text{SO}_3^{2-}
\]

Sulfur Dioxide (acid) bisulfite

“Molecular SO$_2$”

“Free SO$_2$”

achieved by adding sulfite (KMBS)

Free SO$_2$ level needed for 0.8 mg/L molecular SO$_2$ vs. pH

<table>
<thead>
<tr>
<th>Free SO$_2$ (ppm)</th>
<th>13</th>
<th>16</th>
<th>21</th>
<th>26</th>
<th>32</th>
<th>40</th>
<th>50</th>
<th>63</th>
<th>79</th>
<th>99</th>
<th>125</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>3.0</td>
<td>3.1</td>
<td>3.2</td>
<td>3.3</td>
<td>3.4</td>
<td>3.5</td>
<td>3.6</td>
<td>3.7</td>
<td>3.8</td>
<td>3.9</td>
<td>4.0</td>
</tr>
</tbody>
</table>

*Vininmetrica*
Measuring Sulfite (SO₂)

• “Ripper titration”: reaction of SO₂ and iodine
  \[ \text{SO}_2 + \text{I}_2 + \text{H}_2\text{O} \rightarrow 2\text{I}^- + \text{SO}_3 + 2\text{H}^+ \]
  Endpoint detected by starch (blue color) or electrode (Hanna, Vinmetrica)

• Aeration Oxidation (AO)
  \[ \text{SO}_2(\text{g}) + \text{H}_2\text{O}_2 \rightarrow \text{H}_2\text{SO}_4 \]
  Air bubbled through acidified wine sweeps SO₂ into peroxide, giving sulfuric acid that is titrated with NaOH.

• Sentia tester
  - Handheld portable meter with disposable strips

• What is the most reliable method?
**Price/performance for SO₂**

- **Hanna autotitrator**
  - $900
  - 2 min
  - Ripper titration/ORP

- **Aeration Oxidation Setup**
  - $200
  - 20 min
  - Aeration-\(\text{H}_2\text{O}_2\) oxidation/
  - NaOH titration

- **Vinmetrica SC-300 (+ pH & TA)**
  - $500
  - 2 min
  - Ripper titration/Ampero
  - (SC-100A $295)
Vinmetrica SC-300 kit and accessories
Comparison of SO$_2$ methods
Comparison of SO$_2$ methods

Figure 1. Free SO$_2$ 35 mg/L in water
Vinmetrica free $\text{SO}_2$ vs. 99 other labs

2 sweet red wines

29/32 Ripper
32/33 AO
31/34 Other

CTS Wine Industry Interlaboratory Program, Performance Analysis Report, Cycle #065 Summer 2020
Free SO$_2$ levels always drop!

D. Pambianchi, 2014
“A Review of Sulfite Management Protocols Based on SO2 Levels and Type of Wine”
Adjusting SO$_2$

• Potassium metabisulfite (KMBS), 10% solution best
  – e.g., 10 grams KMBS dissolved completely in ~ 85 mL water
  – Make final volume to 100 mL

• Target levels depend on pH and desired “molecular SO$_2$”
  – 0.5 ppm for reds, 0.8 ppm for whites
  – 15 - 40 ppm free SO$_2$ typical

• Online calculators or apps make it easy; “FermCalc”

• Freshly-added SO$_2$ should be re-checked
  – Loss due to binding or dissolved O$_2$ over a few hours
FermCalc for all fermentation needs

- Free
- Java-based App
- Also Android
FermCalc: choose “Stock Solution” for Sulfite Form and leave at 10 g/dL
FermCalc: Enter your data

1. Set “Target Free SO₂ Level” above your measured level
2. Enter Initial Free SO₂ Level (measured value)
3. Enter Wine volume
4. Enter Wine pH
5. NOTE “Resulting Molecular SO₂ Level”
6. Adjust the “Target Free SO₂ Level” to get the molecular SO₂

Example: a red wine with pH 3.65 and free SO₂ just measured at 24 mg/L
A Little Trial and Error

1. "Guess-Set" Target Free SO₂ to 35
2. That produced the desired 0.5 Molecular SO₂!
3. We’ll add 3.6 (4) mL of 10% KMBS
4. Note: white and rosé wines should shoot for 0.8 mg/L Molecular SO₂

Example: a red wine typically should have a "Molecular SO₂" of 0.5 mg/L
Free vs. total $\text{SO}_2$

- Free $\text{SO}_2$ most important for protecting your wine
- Total $\text{SO}_2 = \text{Free } \text{SO}_2 + \text{“bound” } \text{SO}_2$
  - Binding to sugars, aldehydes, lees
  - Significant fraction of added $\text{SO}_2$ can end up bound
- Why total $\text{SO}_2$ values?
  - may be needed for regulatory requirements
  - can tell you about history of additions
- Measure by releasing bound $\text{SO}_2$
  - AO in strong acid
  - Ripper by alkali pretreatment
Sentia Wine Analyzer

- Free SO₂ results in < 60 seconds
- Malic acid in < 60 seconds
- Bluetooth connected
  - Auto updates and data export
- Cost ~$3 per test
- Price ~$1900
- Max free SO₂ is 50 ppm
Sentia Compares with Vinmetrica

Sentia Correlation with Vinmetrica

![Graph showing the correlation between Sentia mg/L free SO2 and Vinmetrica mg/L free SO2. The graph displays a positive linear relationship with a few data points plotted.]
Summary

• Wine’s free SO₂ important for stability and quality
  – Stay on top of your sulfite (monthly)
• Testing is fast, inexpensive (< $1 per test)
• Use sulfite calculators and double check
• Visit Vinmetrica.com/support for more information
Thank you

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• tlikins@vinmetrica.com
• info@vinmetrica.com
• www.vinmetrica.com

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Highlights & Benefits:
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Also offering:

- SO₂ (Free & Total)
- Titratable acidity (TA)
- pH
- Malic acid (MLF)
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- YAN
- ABV%

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