

OREGON WINE



P O R T L A N D

SYMPOSIUM

New Technologies for Redox Measurements for Aging and Maturation

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Overview

- Redox Potential
- Why measure Redox?
- Redox Measurements in Wine
- Antioxidant capacity (CAOX)
- Applications and strategies

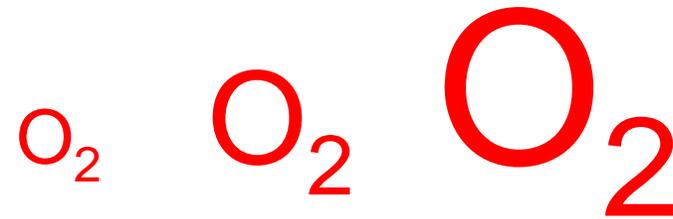
What is redox potential?

- Also known as oxidation-reduction potential
- **Defined: The tendency of a chemical species to accept electrons**
- * Think of it similarly as pH measurements: instead of transfer of protons, as in pH, transfer of electrons between chemical species defines a solution's redox potential.*
- Other industries: Water quality, geology
- First proposed in wine in 1940's (Joslyn 1949)

Why Measure Redox?

- Oxygen management

- How much oxygen (MOX/ Racking)
- When to apply oxygen?



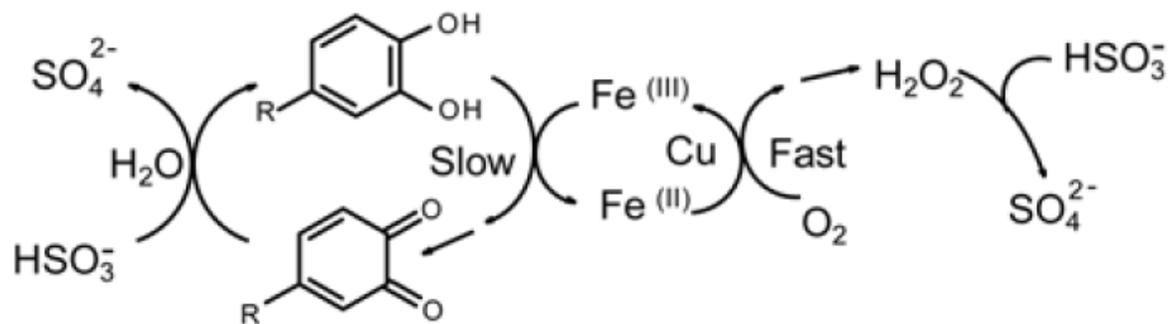
Redox Measurements in Wine: ORP

- ORP – Measured with probe and meter
- Units are in mV
- Range in wine 100 – 300 mV
- Higher mV indicates more oxidative state
- Pros – easy to use, inexpensive equipment, data logging
- Cons – Cleaning, differences between probes, some debate on measurement details



Redox Measurements in Wine: Iron ratios

- $\text{Fe}^{2+} / \text{Fe}^{3+}$ Ratios – spectrophotometric testing of wine oxidation status
- Relies on status of iron to indicate oxidative state



Scheme 1 Proposed mechanism of catechol oxidation in wine. Fe(III)/Fe(II) redox cycling and involvement of SO₂.

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Redox Measurements in Wine: Iron ratios Continued

- Pros – very applicable to wine, can be read via spectrophotometer
- Cons – finicky testing for reds, not commercially available (yet)

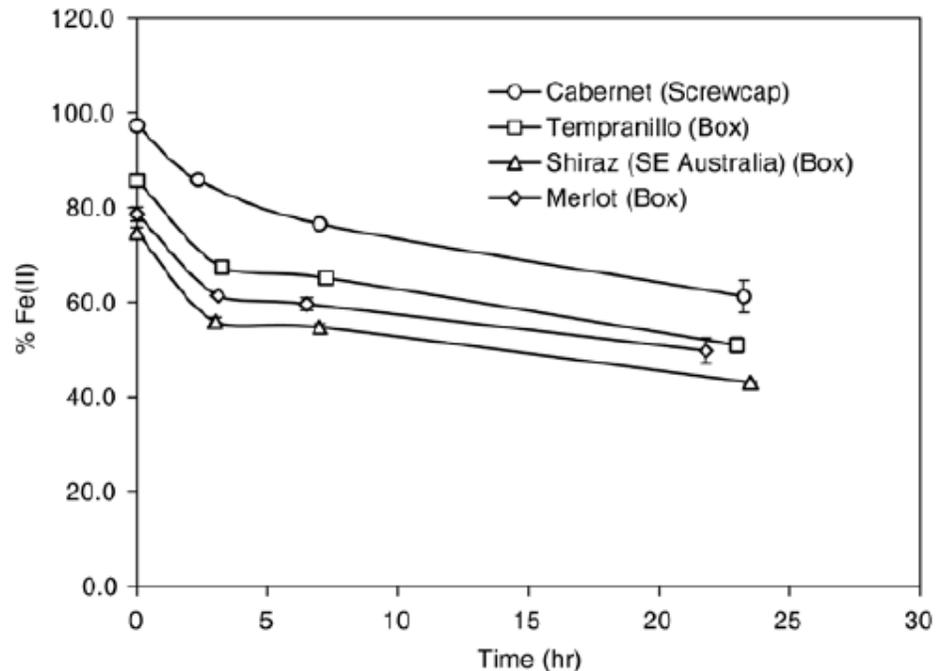


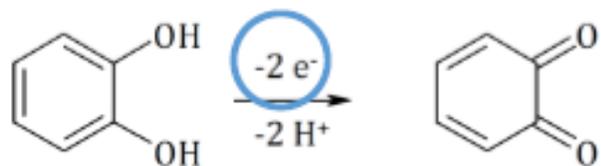
Figure 4 Change in % Fe(II) concentration in air-saturated red wines.

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Antioxidant Capacity - CAOx

- What is CAOx?

An electrochemical method which measures the intensities of electrical power which is proportional to the amount of antioxidant compounds

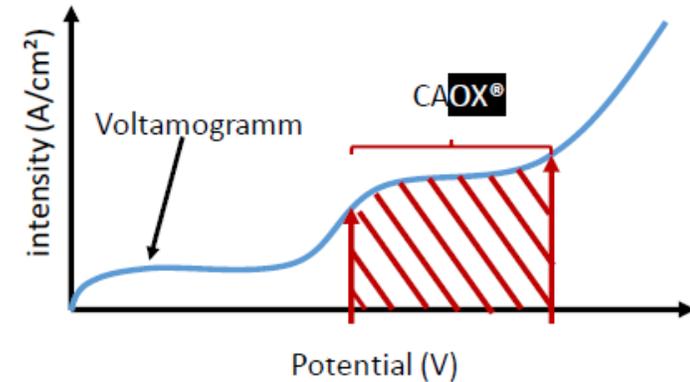
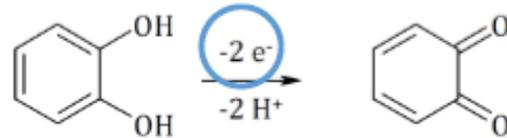
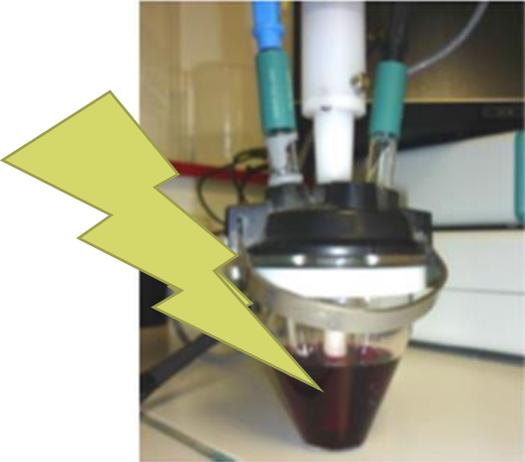


Antioxidant compounds include:

- Phenolics (monomeric and polymeric)
- Glutathione
- Sulfite
- Ascorbic acid

Antioxidant Capacity - CAOx

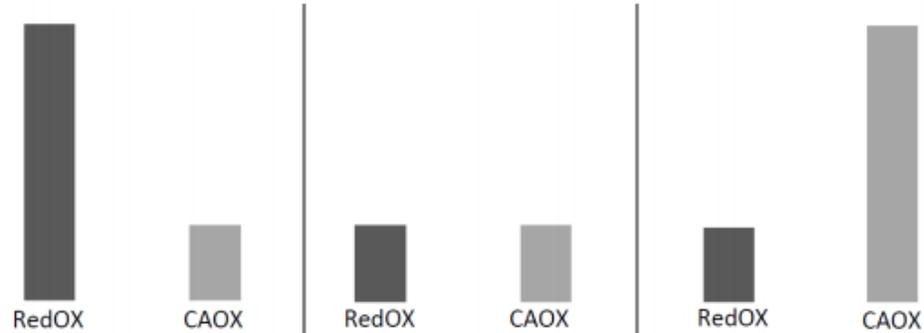
- How does it work?



Interpreting the results CAOX and Redox

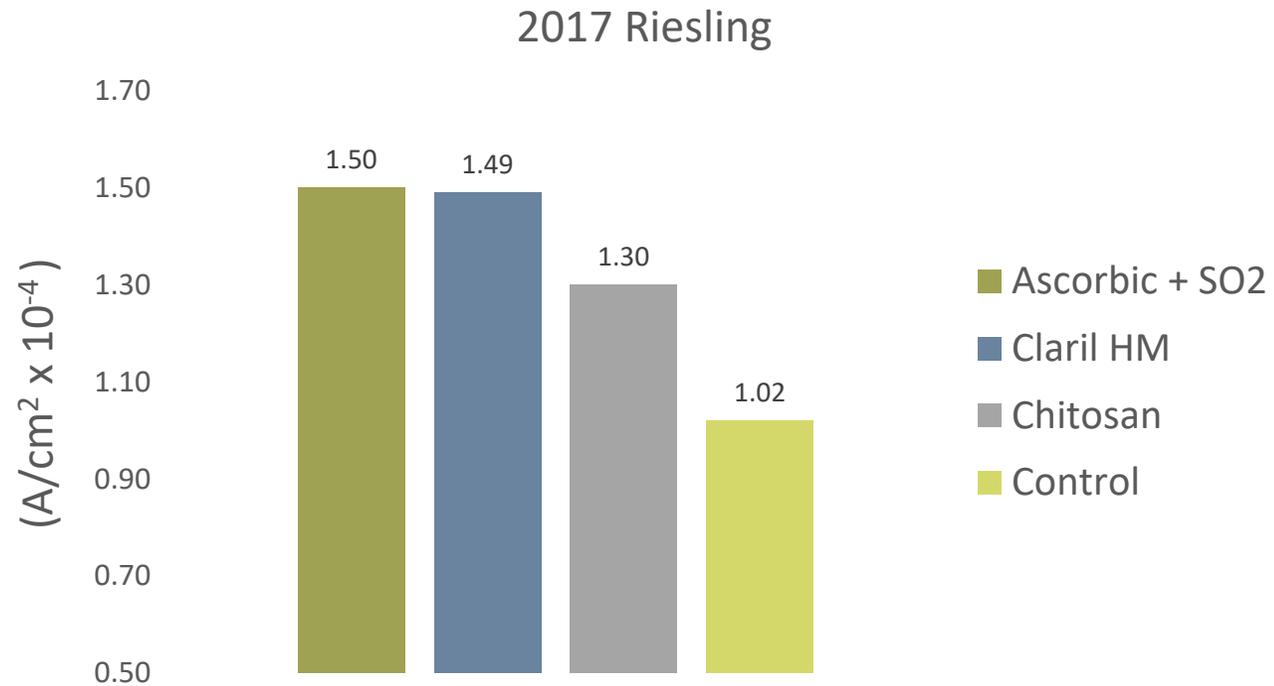
- What do the numbers mean?

CAOX®



AT RISK	NOT STABLE	STABLE
The wine is in an oxidative state and shows low resistance to oxidation.	The wine is in a protective state, but shows low resistance to oxidation. The antioxidant capacity can be improved with adequate ageing.	The wine is in a protective state and shows high resistance to oxidation. Ideal scenario at the beginning of the ageing process.

Comparing Treatments with CAOx



Uses and Timing for Measuring CAOX

Uses

- Oxygen management
- How much oxygen a wine should get post fermentation
- Barrel selection – fine grain or not?
- Micro-ox dosage rates
- Treatments
- Closure decisions



CAOX and Pinot Noir

Comparative data

Over different 160 Pinot Noir wines analyzed from all over USA

Average values for pinot in US : $3.17 \times 10^{-5} \text{ A/cm}^2$

High values: $5.27 \times 10^{-5} \text{ A/cm}^2$

Low values: $2.08 \times 10^{-5} \text{ A/cm}^2$

Conclusions

- Redox measurements can offer more information for wine oxidation
- ORP measurements may offer useful information to winemakers about redox status of a wine, more practical use needed to verify
- Iron ratios may present a new and practical methodology for redox measurements, but still needs some development to make the measurement easier to run
- CAOX offers a measurement for wine resistance to oxidation, and oxidation state

Thank you for your attention!

- For more info Email : Jasha.Karasek@Enartis.com

Sources:

Danilewicz, J. **[Reactions Involving Iron in Mediating Catechol Oxidation in Model Wine]** Am J Enol Vitic. September 2013 64: 316-324; published ahead of print June 03, 2013 ; DOI: 10.5344/ajev.2013.12137

Danilewicz, J. **[Fe(III)]:[Fe(II)] Ratio and Redox Status of Red Wines: Relation to So-Called “Reduction Potential”** American Journal of Enology and Viticulture Apr 2018, 69 (2) 141-147; DOI:10.5344/ajev.2017.1708