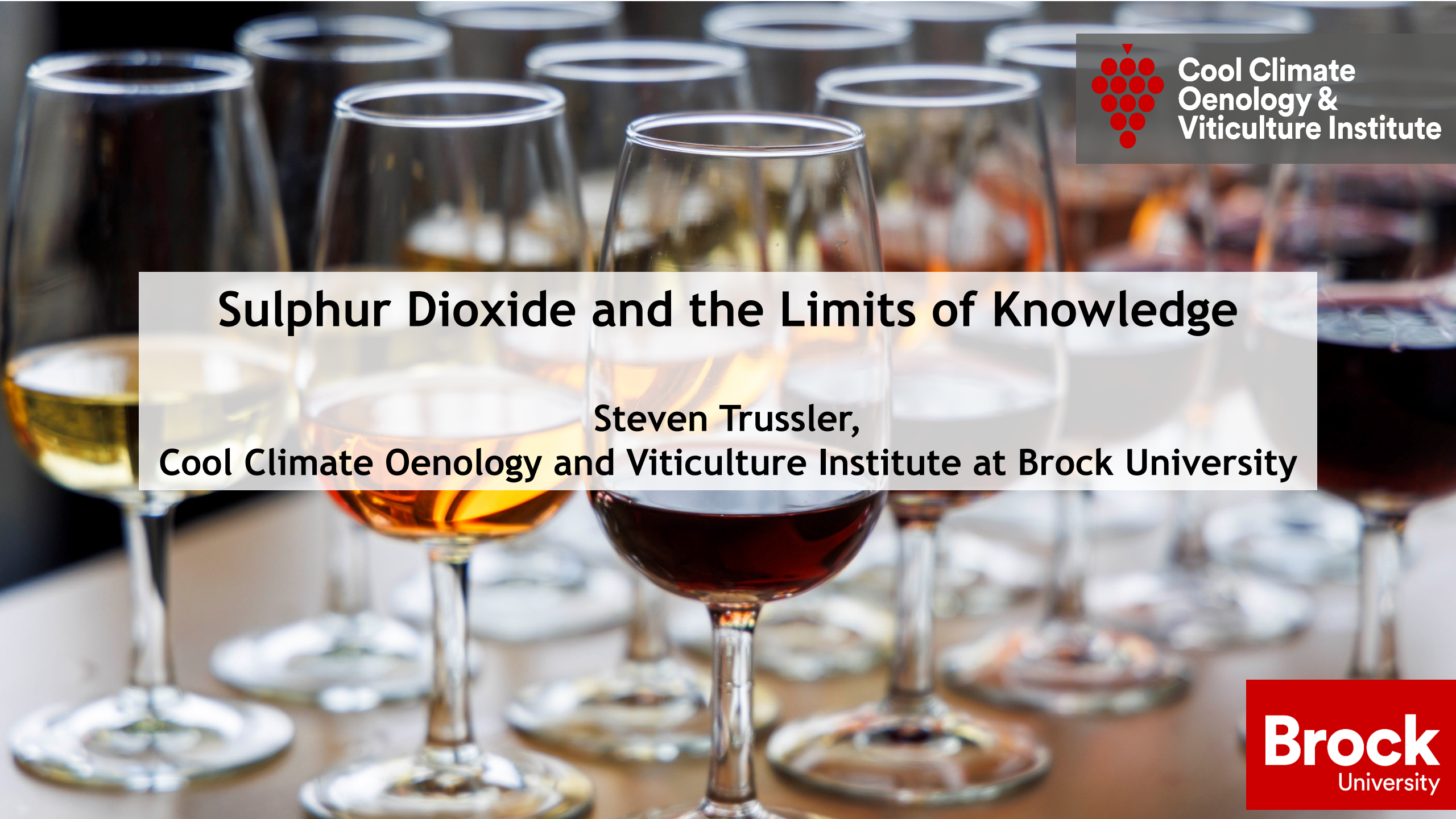


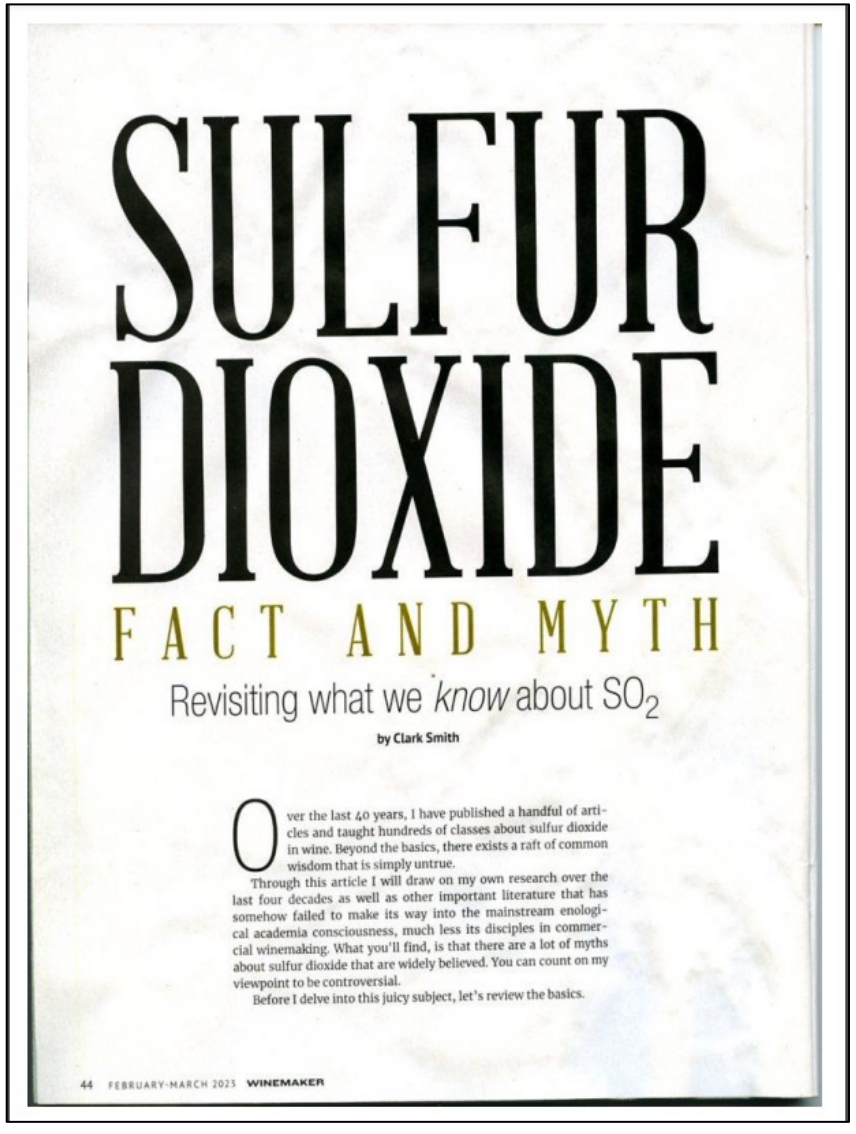
Cool Climate Oenology & Viticulture Institute

Sulphur Dioxide and the Limits of Knowledge

Steven Trussler,
Cool Climate Oenology and Viticulture Institute at Brock University

Brock University

Critical Thinking and Wine: A Personal Case Study



SULFUR DIOXIDE

FACT AND MYTH

Revisiting what we *know* about SO_2

by Clark Smith

Over the last 40 years, I have published a handful of articles and taught hundreds of classes about sulfur dioxide in wine. Beyond the basics, there exists a raft of common wisdom that is simply untrue.

Through this article I will draw on my own research over the last four decades as well as other important literature that has somehow failed to make its way into the mainstream enological academia consciousness, much less its disciples in commercial winemaking. What you'll find, is that there are a lot of myths about sulfur dioxide that are widely believed. You can count on my viewpoint to be controversial.

Before I delve into this juicy subject, let's review the basics.

Determination of Molecular and "Truly" Free Sulfur Dioxide in Wine: A Comparison of Headspace and Conventional Methods

Todd W. Jenkins,[1,3] Patricia A. Howe,[1,2] Gavin L. Sacks,[2]
and Andrew L. Waterhouse[1]*

Questions…

What is ‘knowledge’?
What do we ‘know’ about sulphur dioxide in wine?
What does that ‘knowledge’ mean for practice?

Cool Climate Oenology & Viticulture Institute
Brock University

Cool Climate Oenology & Viticulture Institute
Brock University

In vino veritas

Cool Climate Oenology & Viticulture Institute
Brock University

In vino veritas

Cool Climate Oenology & Viticulture Institute
Brock University

Truth

Knowledge

When thought or language agrees with a mind-independent world

When someone justifiably believes something that is true

Meta-physical problem

Epistemological problem

Cool Climate Oenology & Viticulture Institute
Brock University

Knowledge as justifiable, true, belief

Example 1.

Everyday, Charles eats lunch at 12:30 pm.
It is now 12:30, so you know Charles is eating lunch.
Except today, he is in a meeting running late and not eating.

- ☑ Justifiable
- ☒ True
- ☑ Belief

Example 2.

You are in the desert and see water.
As you approach you realize it was a mirage.
Luckily in that same spot you find water under a rock.

- ☒ Justifiable
- ☑ True
- ☑ Belief

Example 3.

You didn't study for the quiz.
You you use reason to make a best guess on all the answers.
You got all the answers right.

- ☑ Justifiable
- ☑ True
- ☒ Belief

Ways of knowing

Scientific, positivist, causal knowledge	Heuristic, practical, experiential knowledge
What is going on “in” the wine when we add SO2	What is going on “with” the wine when we add SO2
The chemical and physical mechanisms of SO2	The methods and ‘rules of thumb’ when using SO2
Specialized equipment, training, methods	Available to all who practice and share knowledge

…in each case the knowledge must be a true, justified, belief.

Cool Climate Oenology & Viticulture Institute
Brock University

Cool Climate Oenology & Viticulture Institute
Brock University

SULFUR DIOXIDE

FACT AND MYTH

Revisiting what we *know* about SO_2

by Clark Smith

Over the last 40 years, I have published a handful of articles and taught hundreds of classes about sulfur dioxide in wine. Beyond the basics, there exists a raft of common wisdom that is simply untrue.

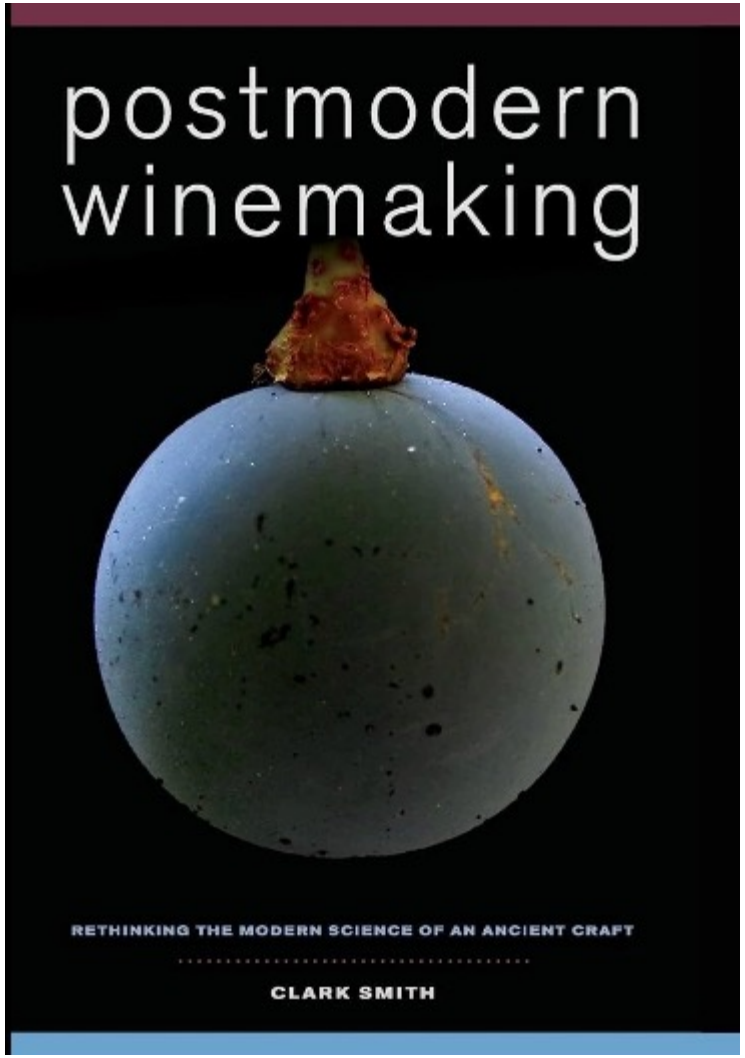
Through this article I will draw on my own research over the last four decades as well as other important literature that has somehow failed to make its way into the mainstream enological academia consciousness, much less its disciples in commercial winemaking. What you'll find, is that there are a lot of myths about sulfur dioxide that are widely believed. You can count on my viewpoint to be controversial.

Before I delve into this juicy subject, let's review the basics.

SULPHUR DIOXIDE

The Limits of
Our Understanding

Clark Smith



Cool Climate Oenology & Viticulture Institute
Brock University

Clark Smith and the Limits of Understanding

"Sulphur Dioxide Fact and Myth: Revisiting what we *know* about SO2" – italics are his

"Over the last 40 years, I have published a handful of articles and taught hundreds of classes about sulfur dioxide in wine. Beyond the basics, there exists a raft of common wisdom that is simply *untrue*" – italics are mine

Cool Climate Oenology & Viticulture Institute
Brock University

Myth number 1

Google Scholar

principles and practices of winemaking

Articles

About 23,000 results (0.08 sec)

Any time
Since 2023
Since 2022
Since 2019
Custom range...

[BOOK] **Principles and practices of winemaking**
RB Boulton, VL Singleton, LF Bisson, RE Kunkee - 2013 - books.google.com
This essential text and reference offers a complete guide to **winemaking**. The authors, all well-known experts in their field, concentrate on the process of wine production, stressing the …
☆ Save Cite Cited by 1735 Related articles All 7 versions

Google Scholar

Bioletti, F. T. 1912. "Sulfurous acid in winemaking." 8th Int. Cong. Ap

Articles

1 result (0.04 sec)

Any time
Since 2023
Since 2022
Since 2019
Custom range...

[CITATION] Sulfurous Acid in Wine-making
FT Bioletti - 1912
☆ Save Cite Cited by 10 Related articles

Cool Climate Oenology & Viticulture Institute
Brock University

Myth number 1

Google Scholar

principles and practices of winemaking

Articles

About 23,000 results (0.08 sec)

Any time
Since 2023
Since 2022

[BOOK] **Principles** and **practices** of **winemaking**
RB Boulton, VL Singleton, LF Bisson, RE Kunkee - 2013 - books.google.com
This essential text and reference offers a complete guide to **winemaking**. The authors, all

-Earliest recorded use was 1449
-OR??? The Romans “didn’t like it’s effects on wine”

Articles

1 result (0.04 sec)

Any time
Since 2023
Since 2022
Since 2019
Custom range...

[CITATION] Sulfurous Acid in Wine-making
FT Bioletti - 1912
Save Cite Cited by 10 Related articles

Myth number 2

Wine requires sulfites to avoid spoilage

"According to Dr. Andrew Waterhouse, former chairman of the Dept. of Viticulture and Enology at UC-Davis, 'Without sulfites, wine is extremely perishable and should be refrigerated for its entire 1-year life cycle between harvest…and consumer.' So how come my sulfite-free WineSmith Roman Reserve wines…are still my best-selling wines?"

Myth number 2

Wine requires sulfites to avoid spoilage

how come my sulfite-free WineSmith Roman Reserve wines…are still my best-selling wines?"

If knowledge is true, justifiable, belief, then:

He believes that his best-selling wine is the Roman Reserve, which can be justified by receipts analysis, and is probably objectively true.

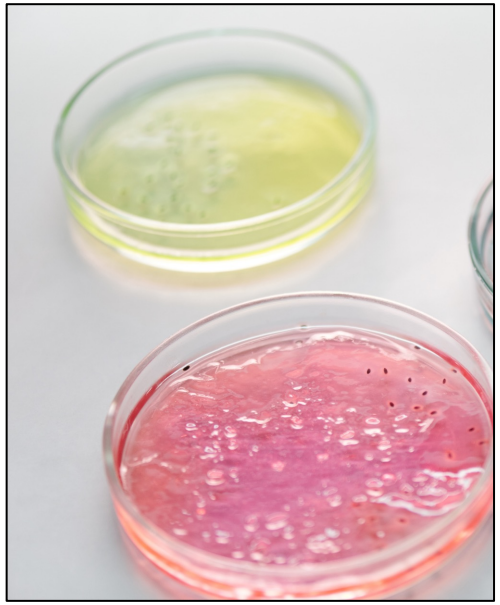
We now know that Roman Reserve is his best seller. And nothing else.

Cool Climate Oenology & Viticulture Institute
Brock University

Myth number 2

Wine requires sulfites to avoid spoilage

Anti-oxidant



Anti-microbial

Cool Climate Oenology & Viticulture Institute
Brock University

Myth number 2

Wine requires sulfites to avoid spoilage

Anti-oxidant

Some SO2 (10 to 15 ppm Free)

100% oxygen free winemaking

Tannins

Cool Climate Oenology & Viticulture Institute
Brock University

Myth number 2

Wine requires sulfites to avoid spoilage

0.8 ppm molecular SO2

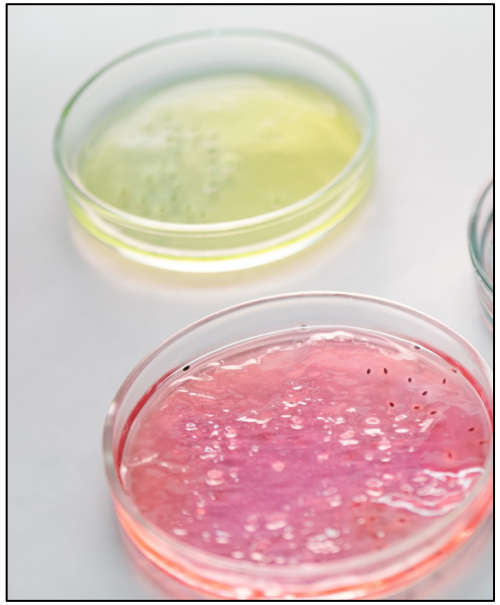
Cold chain

Nutrient Desert

Filtering

Velcorin

Chitin, Lysosyme, Sorbate



Anti-microbial

Cool Climate Oenology & Viticulture Institute
Brock University

Myth number 3: Free SO2 is a potent anti-oxidant that scavenges oxygen and protects wines from oxidation in racking and bottling

4. Ugliano, M. Oxygen Contribution to Wine Aroma Evolution during Bottle Aging J. Agric. Food Chem. **2013**, 61, 6125– 6136 DOI: 10.1021/jf400810v [ACS Full Text], [CAS], [Google Scholar] open URL

5. Waterhouse, A. L.; Laurie, V. F. Oxidation of wine phenolics: A critical evaluation and hypotheses Am. J. Enol. Vitic. **2006**, 57, 306– 313 [Crossref], [CAS], [Google Scholar] open URL

6. Singleton, V. L. Oxygen with Phenols and Related Reactions in Musts, Wines and Model Systems— Observations and Practical Implications Am. J. Enol. Vitic. **1987**, 38, 69– 77 [CAS], [Google Scholar] open URL

7. Danilewicz, J. C. Interaction of sulfur dioxide, polyphenols, and oxygen in a wine-model system: Central role of iron and copper Am. J. Enol. Vitic. **2007**, 58, 53– 60 [Crossref], [CAS], [Google Scholar] open URL

Cool Climate Oenology & Viticulture Institute
Brock University

Myth number 3: Free SO2 is a potent anti-oxidant that scavenges oxygen and protects wines from oxidation in racking and bottling

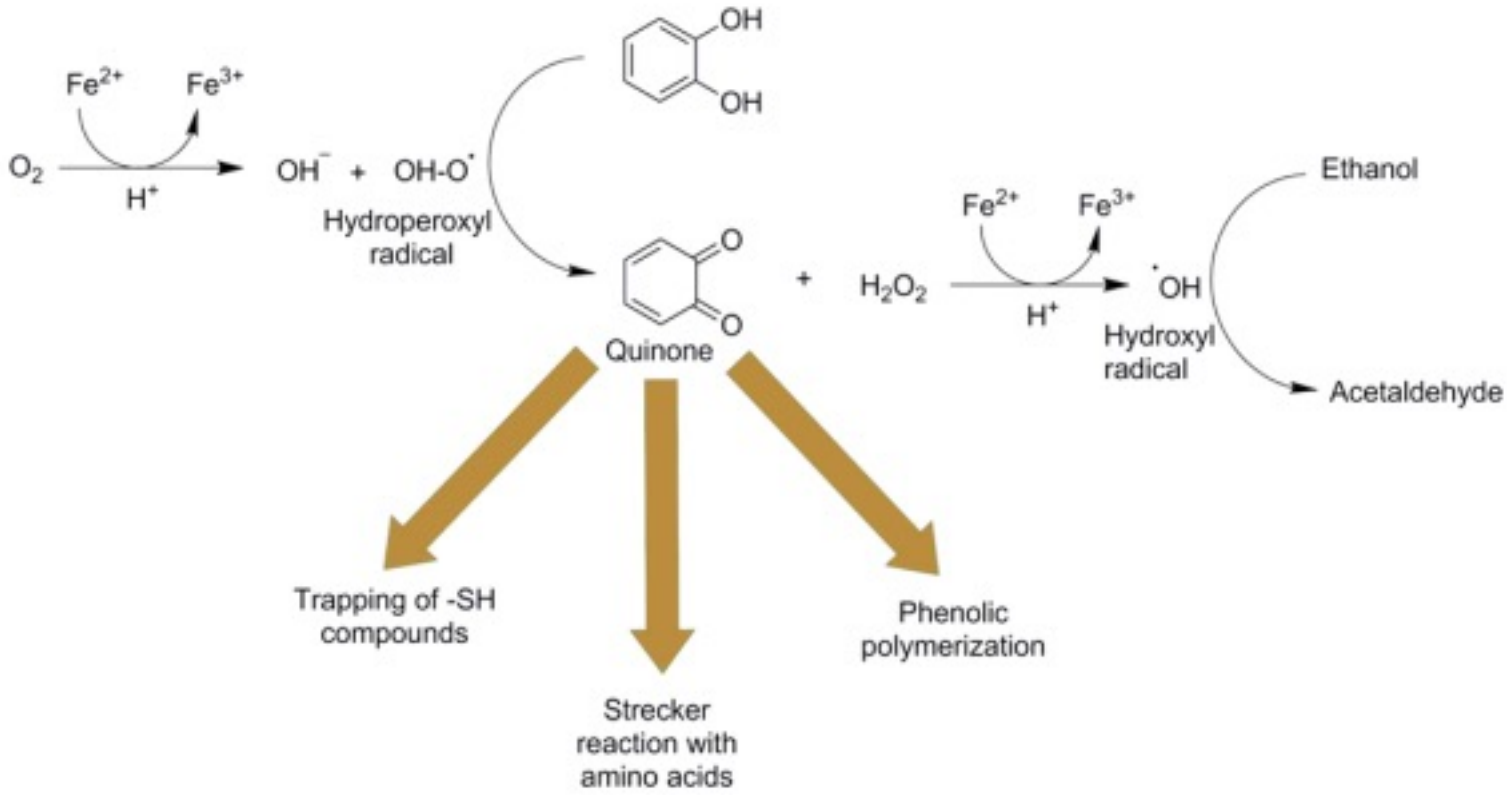
Oxygenation

vs

Oxidation

Cool Climate Oenology & Viticulture Institute
Brock University

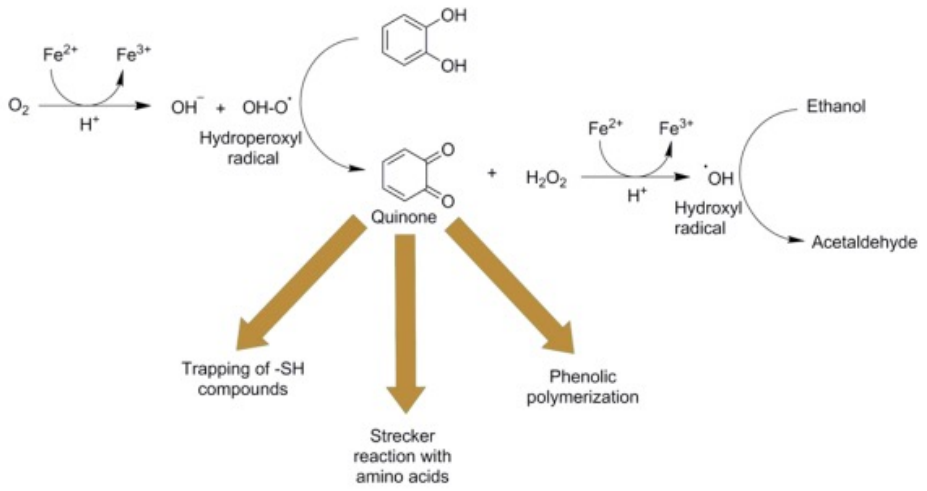
Myth number 3: Free SO2 is a potent anti-oxidant that scavenges oxygen and protects wines from oxidation in racking and bottling



Ugliano, Maurizio. “Oxygen Contribution to Wine Aroma Evolution During Bottle Aging.” *Journal of agricultural and food chemistry* 61.26 (2013): 6125–6136. Web.

Cool Climate Oenology & Viticulture Institute
Brock University

Myth number 3: Free SO2 is a potent anti-oxidant that scavenges oxygen and protects wines from oxidation in racking and bottling

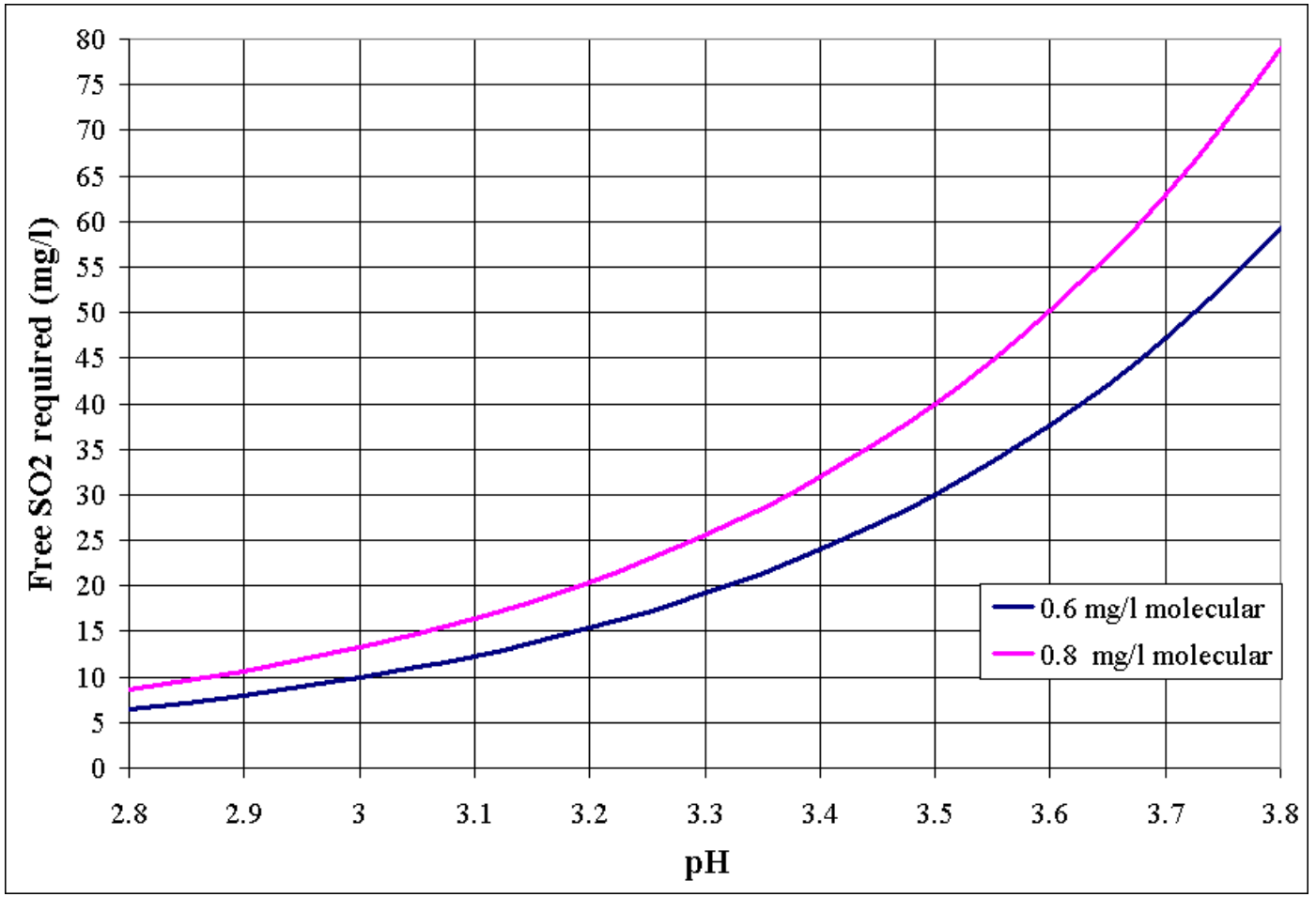


Justifiable (yes), belief (yes), true (…)

Ugliano, Maurizio. “Oxygen Contribution to Wine Aroma Evolution During Bottle Aging.” *Journal of agricultural and food chemistry* 61.26 (2013): 6125–6136. Web.

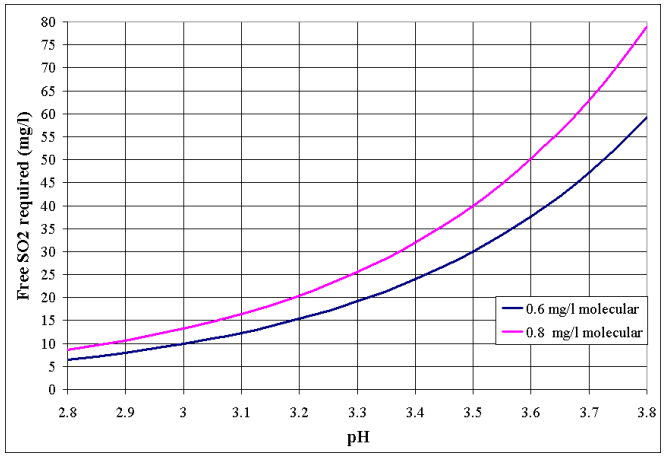
Cool Climate Oenology & Viticulture Institute
Brock University

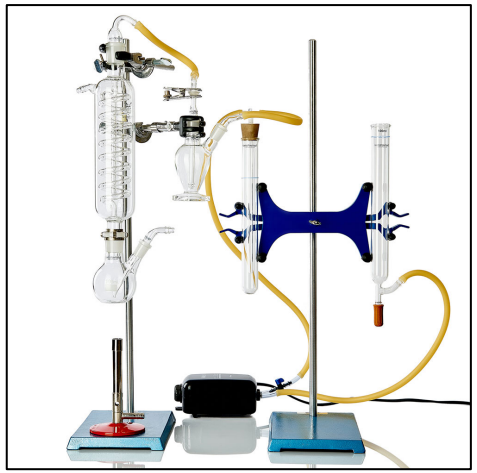
Myth number 3: Free SO2 is a potent anti-oxidant that scavenges oxygen and protects wines from oxidation in racking and bottling – MEASURING SO2



Cool Climate Oenology & Viticulture Institute
Brock University

Myth number 3: Free SO2 is a potent anti-oxidant that scavenges oxygen and protects wines from oxidation in racking and bottling – MEASURING SO2





AMERICAN JOURNAL of ENOLOGY AND VITICULTURE

search

Advanced Search

Home Content Information For About Us Feedback Alerts Help Login ASEV MEMBER LOGIN

Research Article

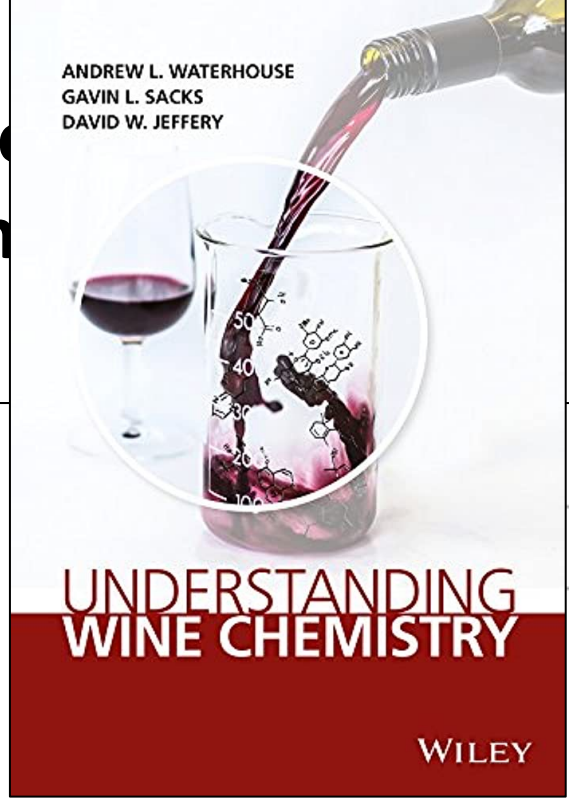
Determination of Molecular and "Truly" Free Sulfur Dioxide in Wine: A Comparison of Headspace and Conventional Methods

Todd W. Jenkins, Patricia A. Howe, Gavin L. Sacks, Andrew L. Waterhouse

Am J Enol Vitic. July 2020 71: 222-230; published ahead of print March 13, 2020 ; **DOI:** 10.5344/ajev.2020.19052

Cool Climate Oenology & Viticulture Institute
Brock University

Myth number 3: Free SO2 is a potent anti-o scavenges oxygen and protects wines from racking and bottling – MEASURING SO2



AMERICAN JOURNAL of ENOLOGY AND VITICULTURE

Home | Content | Information For | About Us | Feedback | Alerts | Help | Login

Research Article

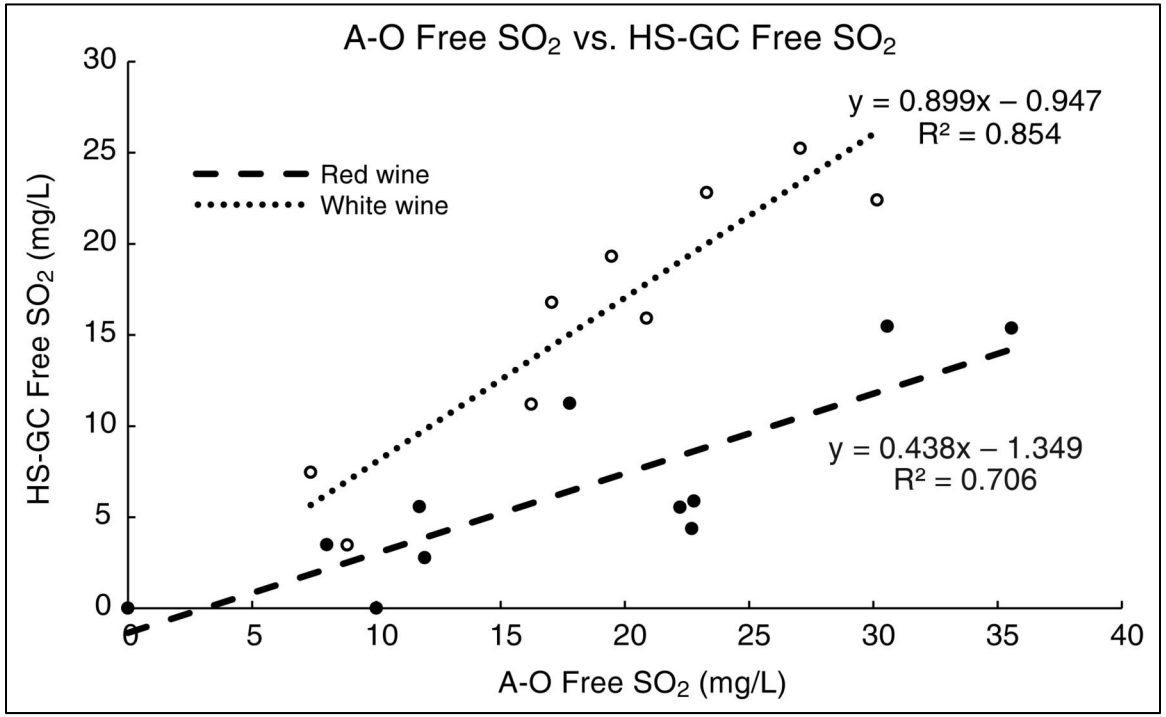
Determination of Molecular and "Truly" Free Sulfur Dioxide in Wine: Headspace and Conventional Methods

Todd W. Jenkins, Patricia A. Howe, Gavin L. Sacks, Andrew L. Waterhouse

Am J Enol Vitic. July 2020 71: 222-230; published ahead of print March 13, 2020 ; **DOI:** 10.5344/ajev.2020.19052

Cool Climate Oenology & Viticulture Institute
Brock University

Myth number 3: Free SO2 is a potent anti-oxidant that scavenges oxygen and protects wines from oxidation in racking and bottling – MEASURING SO2

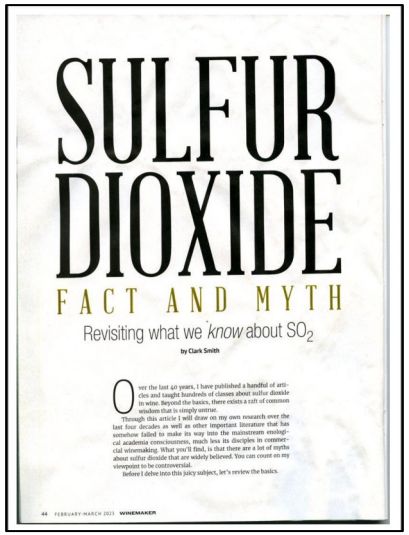


Waterhouse

"Conventional SO2 methods systemically overestimate molecular and free SO2"

Cool Climate Oenology & Viticulture Institute
Brock University

Myth number 3: Free SO2 is a potent anti-oxidant that scavenges oxygen and protects wines from oxidation in racking and bottling – MEASURING SO2



SULFUR DIOXIDE

FACT AND MYTH

Revisiting what we *know* about SO_2

by Clark Smith

Over the last 40 years, I have published a handful of articles and taught hundreds of classes about sulfur dioxide in wine. Beyond the basics, there exists a raft of common wisdom that is simply untrue.

Through this article I will draw on my own research over the last four decades as well as other important literature that has somehow failed to make its way into the mainstream enological academia consciousness, much less its disciples in commercial winemaking. What you'll find, is that there are a lot of myths about sulfur dioxide that are widely believed. You can count on my viewpoint to be controversial.

Before I delve into this juicy subject, let's review the basics.

44 FEBRUARY-MARCH 2023 WINEMAKER

Smith

"Little-known thesis"
"…was never published in a peer-reviewed journal"
"we tried to publish…but politics intervened"
"This is how academic publication politics works."

"Free SO2 doesn't exist at all in young red wines"
"When you measure SO2 in the headspace above red wines you find little or none"

Cool Climate Oenology & Viticulture Institute
Brock University

Myth number 4: Even if no sulfur dioxide is added to wine, fermenting yeasts will produce SO2 from the naturally occurring inorganic sulfates in all grape juices. Thus, it is impossible for any wine to be completely free of sulfur dioxide.

Cool Climate Oenology & Viticulture Institute
Brock University

Front. Cell Dev. Biol., 07 October 2021
Sec. Cell Death and Survival
Volume 9 - 2021 | https://doi.org/10.3389/fcell.2021.729728

This article is part of the Research Topic
Programmed Cell Death and Cardiovascular Disease
View all 26 Articles >

Endogenous SO_2 Controls Cell Apoptosis: The State-of-the-Art

Yingying Li[1,2†], Yingjun Feng[2†], Xiaoyun Ye[1†], Hanlin Peng[1], Jiantong Du[3], Xiaoli Yao[2], Yaqian Huang[1*], Hongfang Jin[1*] and Junbao Du[1,4*]

[1] Department of Pediatrics, Peking University First Hospital, Beijing, China
[2] Department of Cardiovascular Medicine, Children's Hospital Affiliated to Zhengzhou University/Children's Hospital of Henan Province, Zhengzhou, China
[3] Department of Ophthalmology, Peking University First Hospital, Beijing, China
[4] Key Lab of Molecular Cardiology, Ministry of Education, Beijing, China

SO_2, previously known as the product of industrial waste, has recently been proven to be a novel gasotransmitter in the cardiovascular system. It is endogenously produced from the metabolism pathway of sulfur-containing amino acids in mammalians. Endogenous SO_2 acts

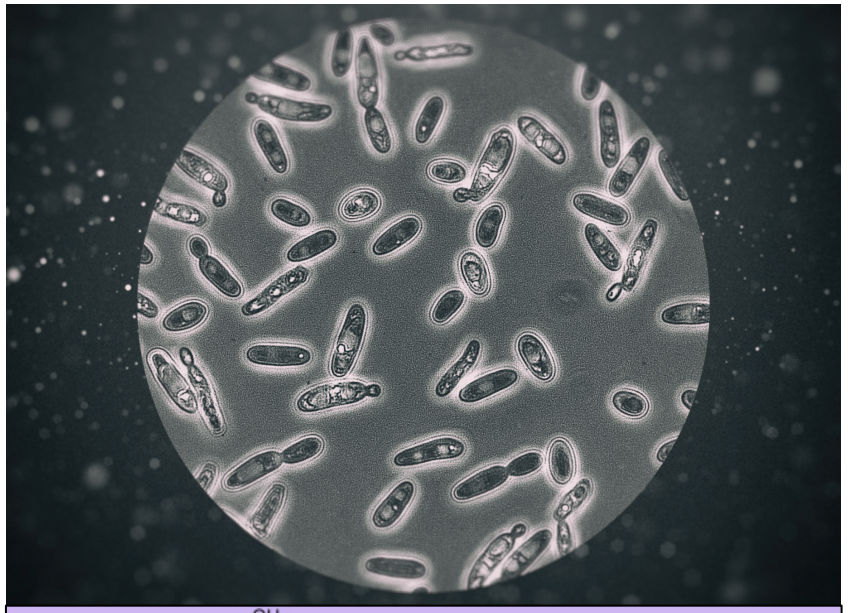
Li, Yingying et al. "Endogenous SO2 Controls Cell Apoptosis: The State-of-the-Art." *Frontiers in cell and developmental biology* 9 (2021): 729728–729728.

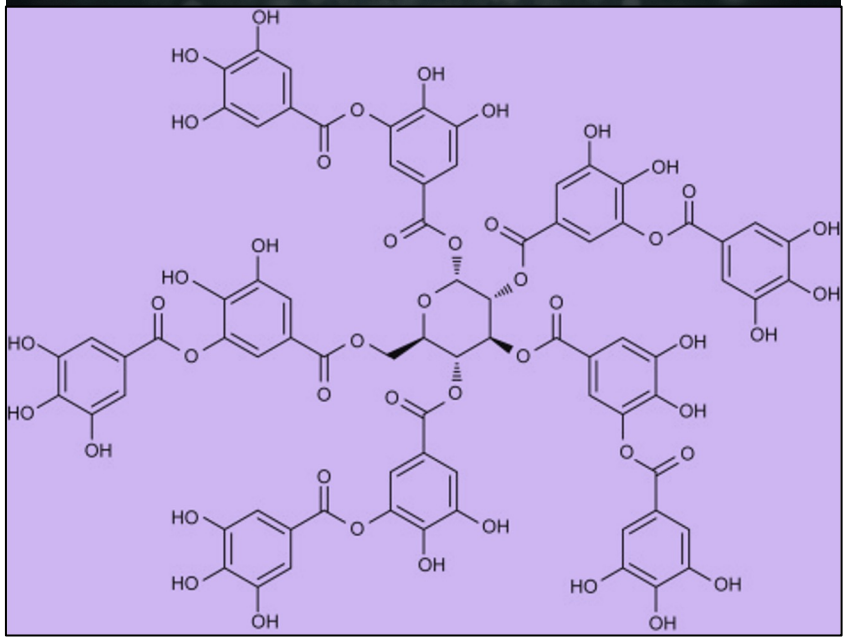
Cool Climate Oenology & Viticulture Institute
Brock University

Use SO2 in red wines?

Microbiome

Tannins





So what?

Truth

Knowledge

- Interrupts oxidation reactions
- Important for white wine making
- In some situations, controls microbial spoilage

Heuristic, Practical, Experiential

and/or

Scientific, Positivist, Causal

Cool Climate Oenology & Viticulture Institute
Brock University

Liu, Cixin. & Liu, Ken. (2014). *The three-body problem*. New York : Tor Books

Cool Climate Oenology & Viticulture Institute

Every morning on a turkey farm, the farmer comes to feed the turkeys. A scientist turkey, having observed this pattern to hold without change for almost a year, makes the following discovery: "Every morning at eleven, food arrives." On the morning of Thanksgiving, the scientist announces this law to the other turkeys. But that morning at eleven, food doesn't arrive; instead, the farmer comes and kills the entire flock."

Brock University

Cool Climate Oenology & Viticulture Institute
Brock University

THANK YOU!

References

Jenkins, Todd W. et al. “Determination of Molecular and ‘Truly’ Free Sulfur Dioxide in Wine: A Comparison of Headspace and Conventional Methods.” *American journal of enology and viticulture* 71.3 (2020): 222–230.

Li, Y., Feng, Y., Ye, X., Peng, H., Du, J., Yao, X., ... & Du, J. (2021). Endogenous SO2 controls cell apoptosis: the state-of-the-art. *Frontiers in Cell and Developmental Biology*, *9*, 729728.

Liu, Cixin. & Liu, Ken. (2014). *The three-body problem*. New York : Tor Books

Smith, C. (February-March, 2023). Sulfur dioxide: Fact and Myth. *Winemaker Magazine*. https://winemakermag.com/article/sulfur-dioxide-fact-and-myth

Ugliano, Maurizio. “Oxygen Contribution to Wine Aroma Evolution During Bottle Aging.” *Journal of agricultural and food chemistry* 61.26 (2013): 6125–6136

Waterhouse, Andrew Leo, Gavin L. Sacks, and David W. Jeffery. *Understanding Wine Chemistry*. Chichester, West Sussex: Wiley, 2016. Print.