



Mythbusting

Sparkling Wine does not pick up oxygen

Warren Roget





Content

- Introduction to oxygen in wines
- Concept of total package oxygen
- Benchmarking bottling line performance
- Mitigation of high TPO
- Shelf life and quality impacts
- Closure impact



Oxygen Management Matters

- 1999 White wine closure trial
 - Every closure technology produced a different wine
 - Range of colour at 28 months



(Godden et al 2001 Aust. J. Grape Wine Res. 7, 62-105)





Introduction – Oxygen in wine

- Before bottling
- At bottling
 - Dissolved in wine
 - Headspace oxygen
 - Closure in situ
- Post bottling – closure oxygen transmission rate (OTR)

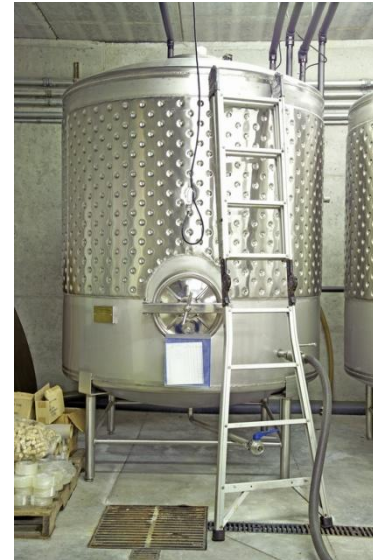


Bottle image provided by Stéphane Vidal, Nomacorc



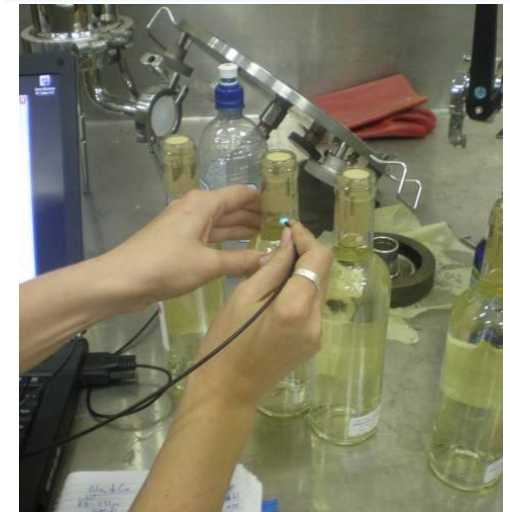
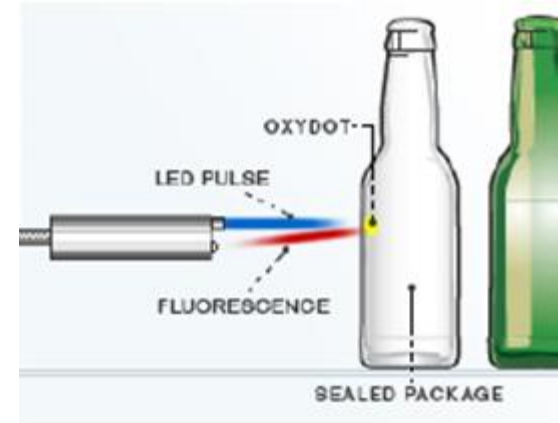
Bottling oxygen management

- Current oxygen management regimes:
 - In the bottling tank; and
 - Dissolved in the packaged wine
- This only tells part of the story, even when shaking protocols are used
- Total package oxygen is the critical performance parameter



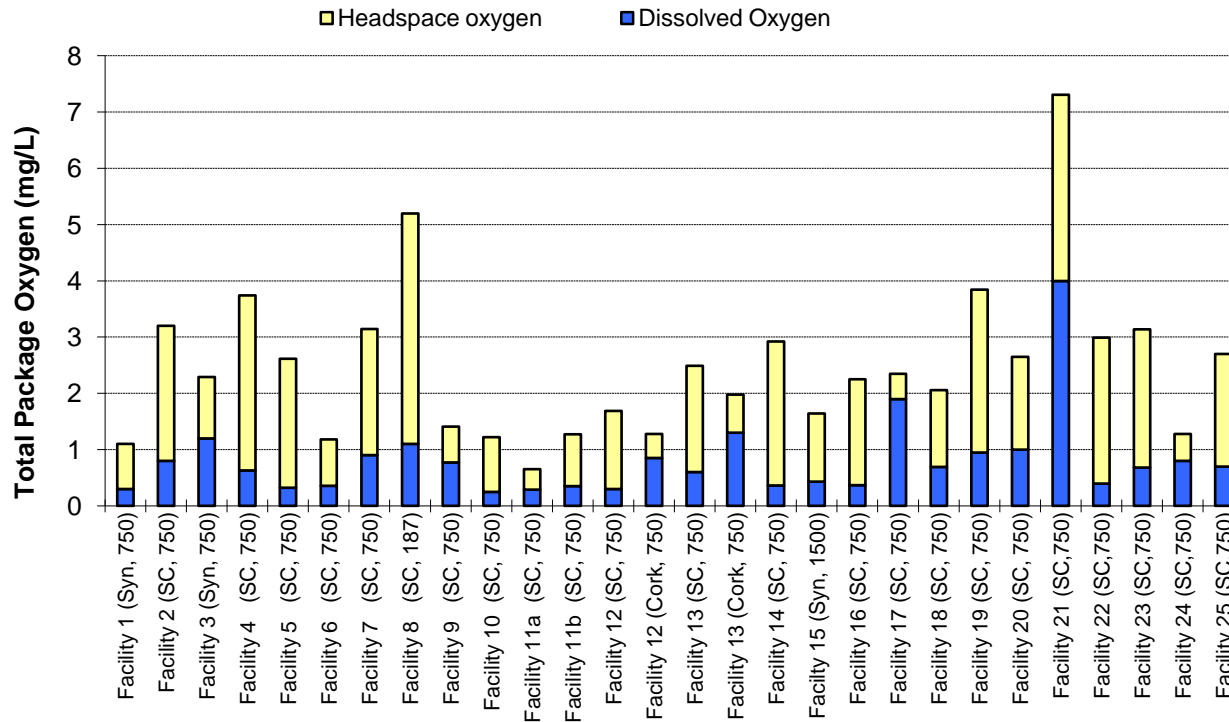
Total package oxygen measurement

- Quantifies dissolved oxygen AND the gaseous oxygen in the headspace
 - Reference method: NomaSense optical sensing technology
 - Oxygen sensitive spots are glued into the bottles
 - The oxygen spot is illuminated with a blue light, and it then emits a signal intensity proportional to the oxygen concentration





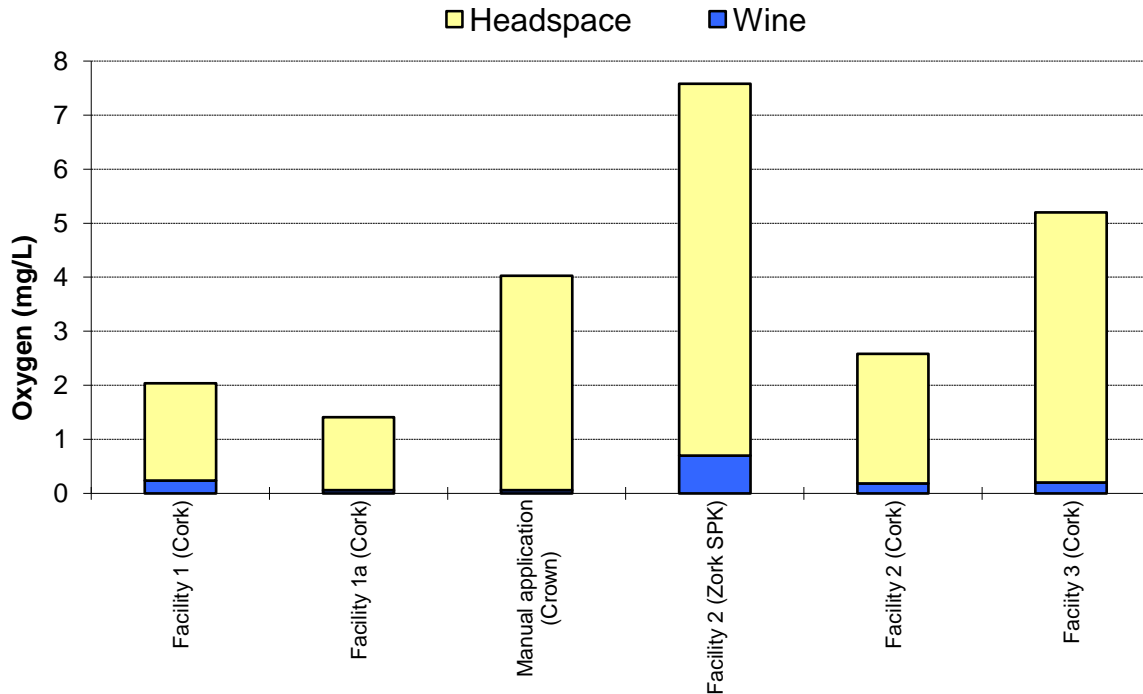
Still wine TPO at bottling



- Headspace oxygen dominates
- Performance in TPO management variable



Sparkling wine TPO at bottling



- Headspace oxygen dominates....even more so!
- Absolute TPO still variable
- Average sparkling TPO > still wine TPO



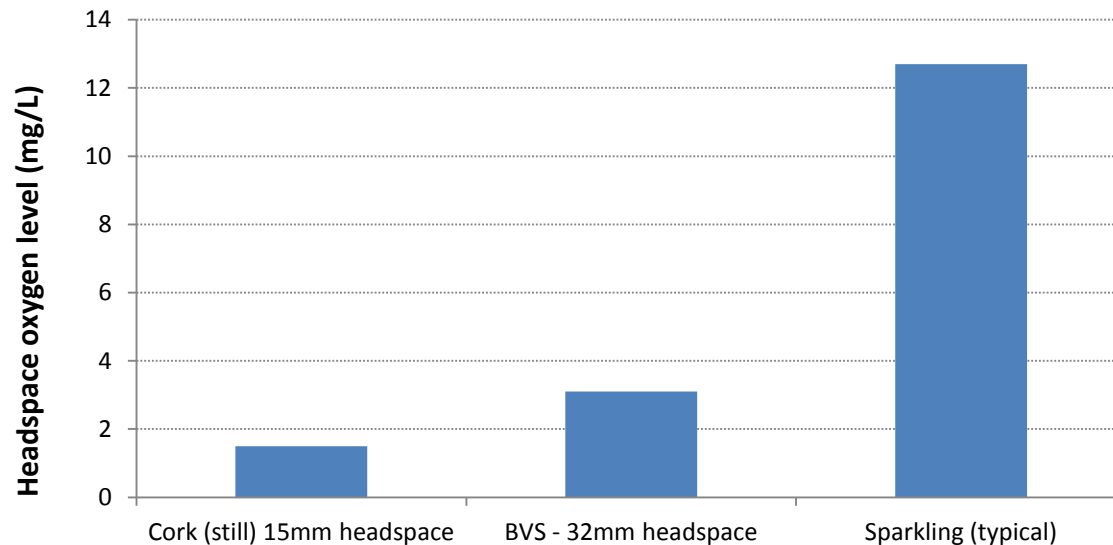


Potential headspace oxygen levels

$$PV = mRT$$

Ideal gas law

$$m = \frac{PV}{RT}$$



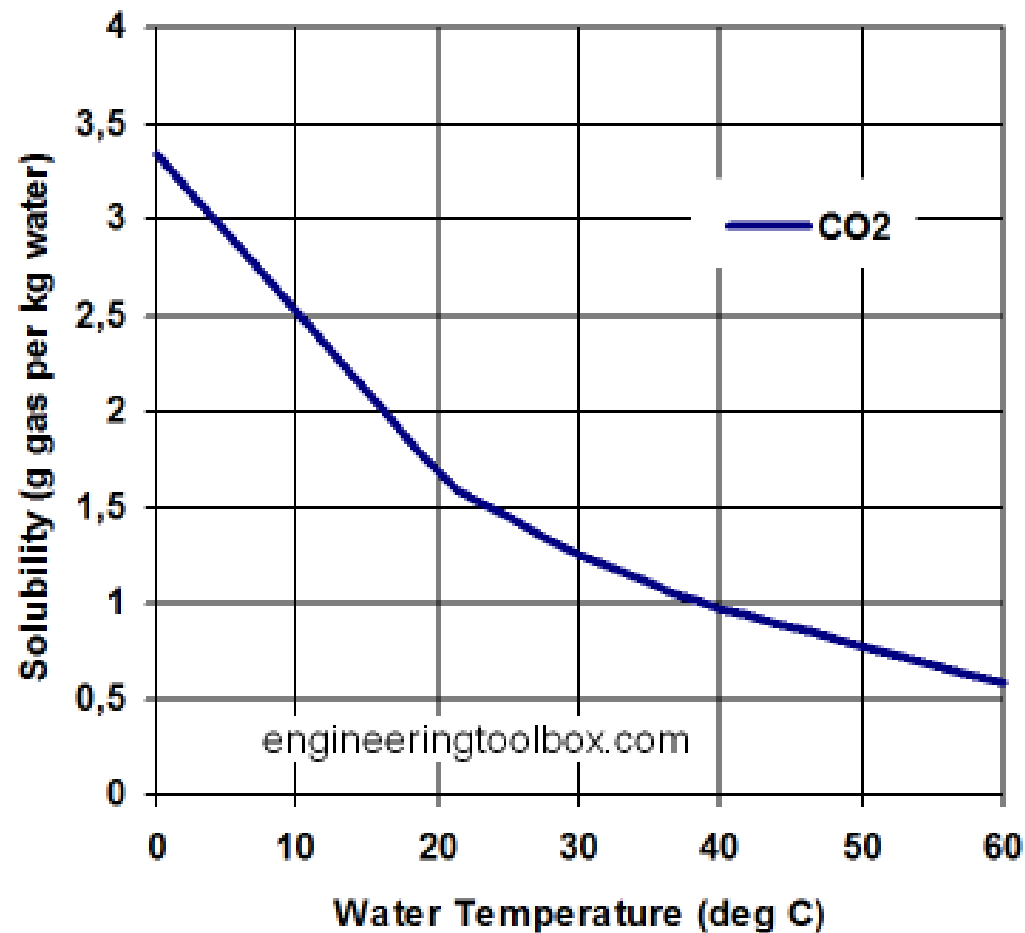
TPO reduction strategies

- Reduce headspace volume
 - May not be feasible
- Reduce headspace oxygen concentration
 - Optimising line configuration – minimise distance from filler to corker
 - Filling warmer
 - Inert gas or cryogenic dosing
 - Beer strategies (fobbing)





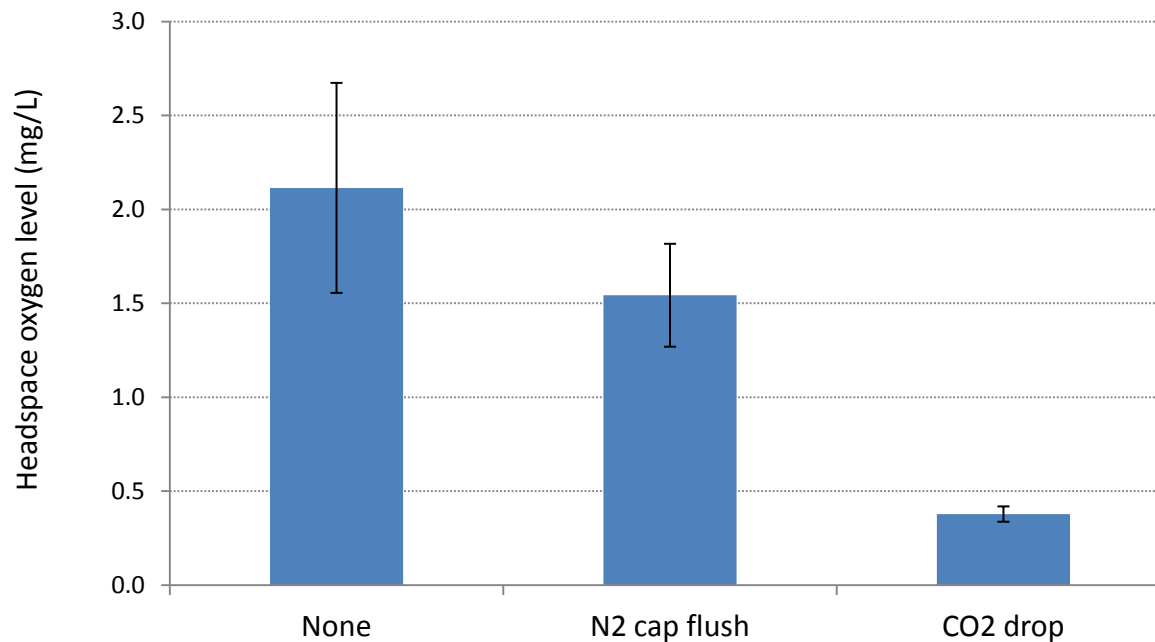
CO₂ Solubility





Headspace treatment

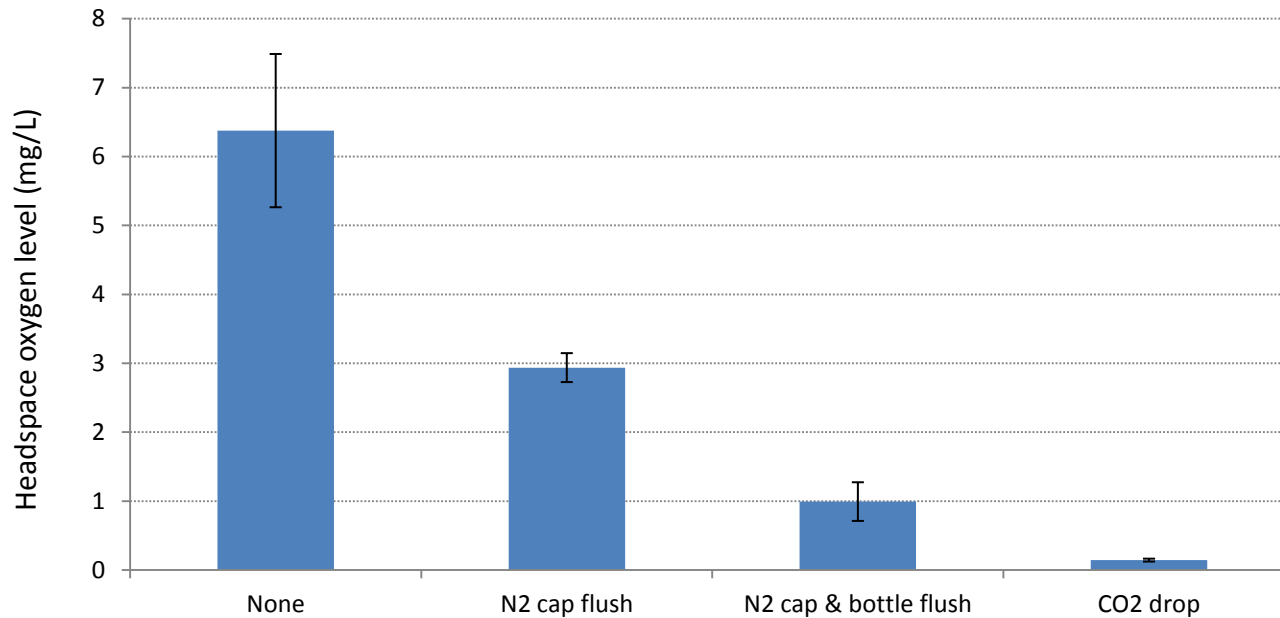
Lab scale trial investigating headspace treatments



Headspace treatment

Lab scale trial investigating headspace treatments

- repeated 5 minutes after initial trial



Relevance to disgorging?



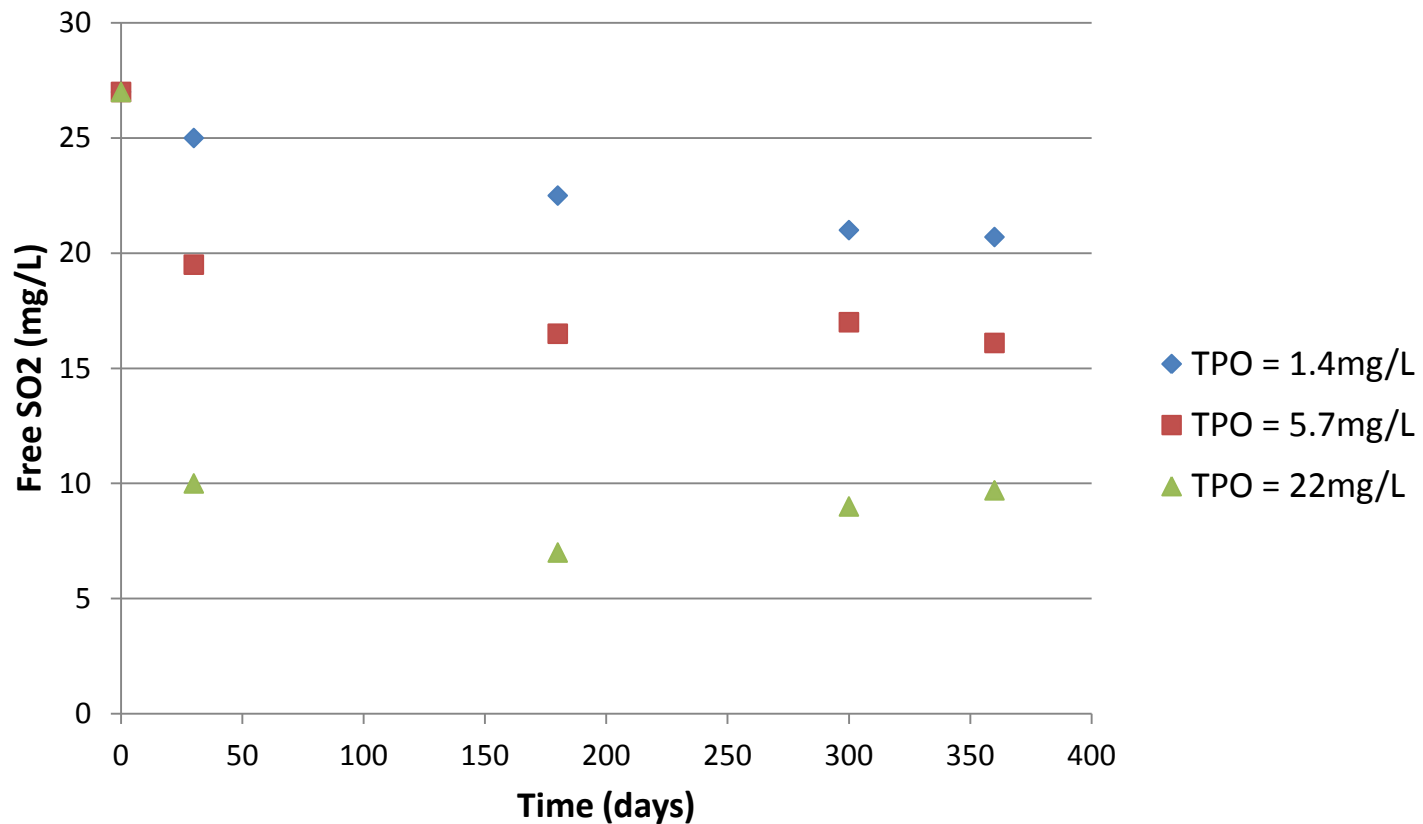
Impacts – Quality and shelf life

- Absolute quality impacts are matrix dependant
 - Additional work required to fully understand impact of differing TPO levels
- Bottle – bottle variability
 - Resulting from online collisions and/or stoppages
- Shelf life is unquestionable impacted



Impact of headspace oxygen

Red wine closure trial, 12 months post-bottling



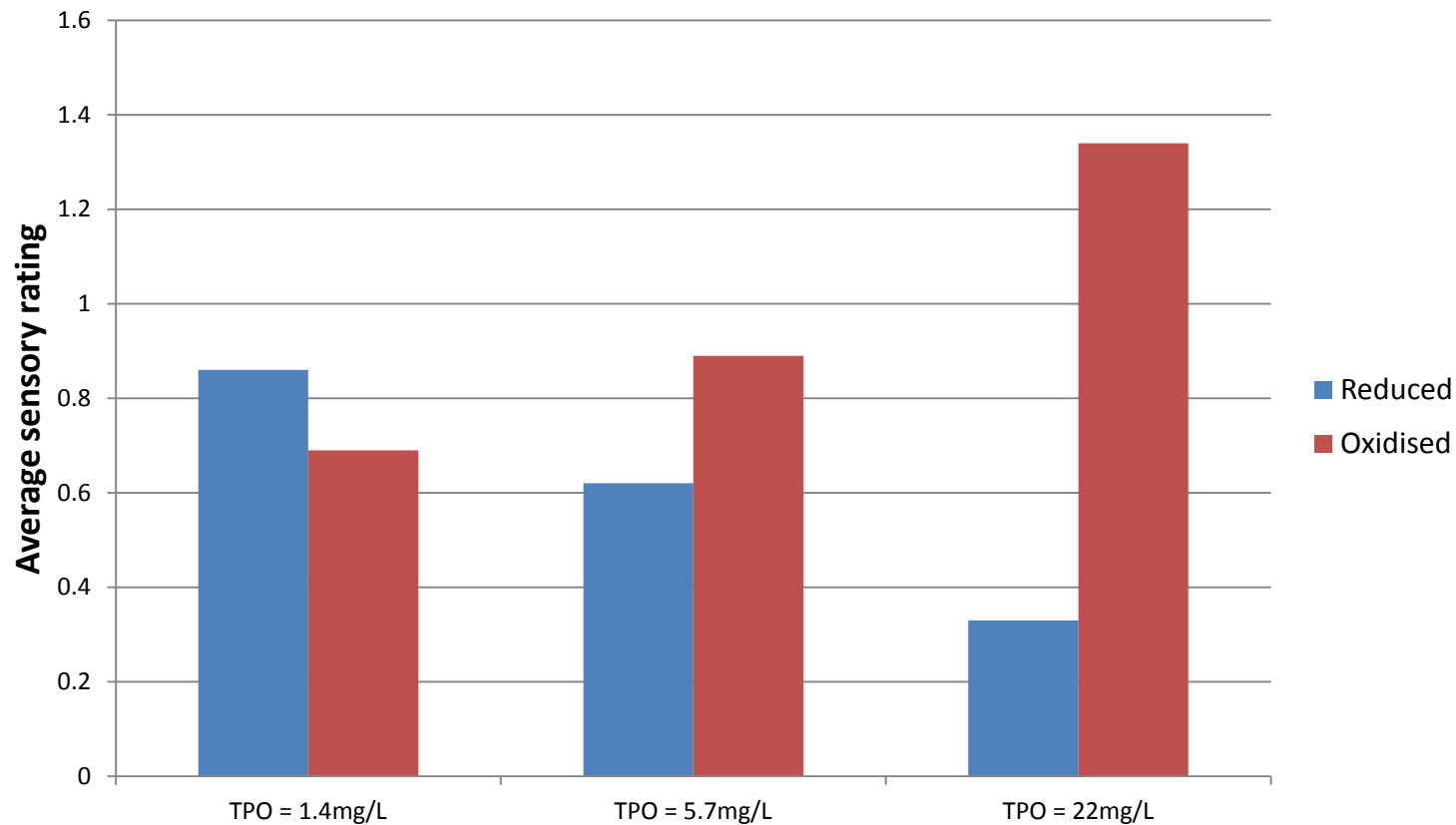
Kwiatkowski et al 2007, AJGWR





Impact of headspace oxygen

Red wine closure trial, 12 months post-bottling

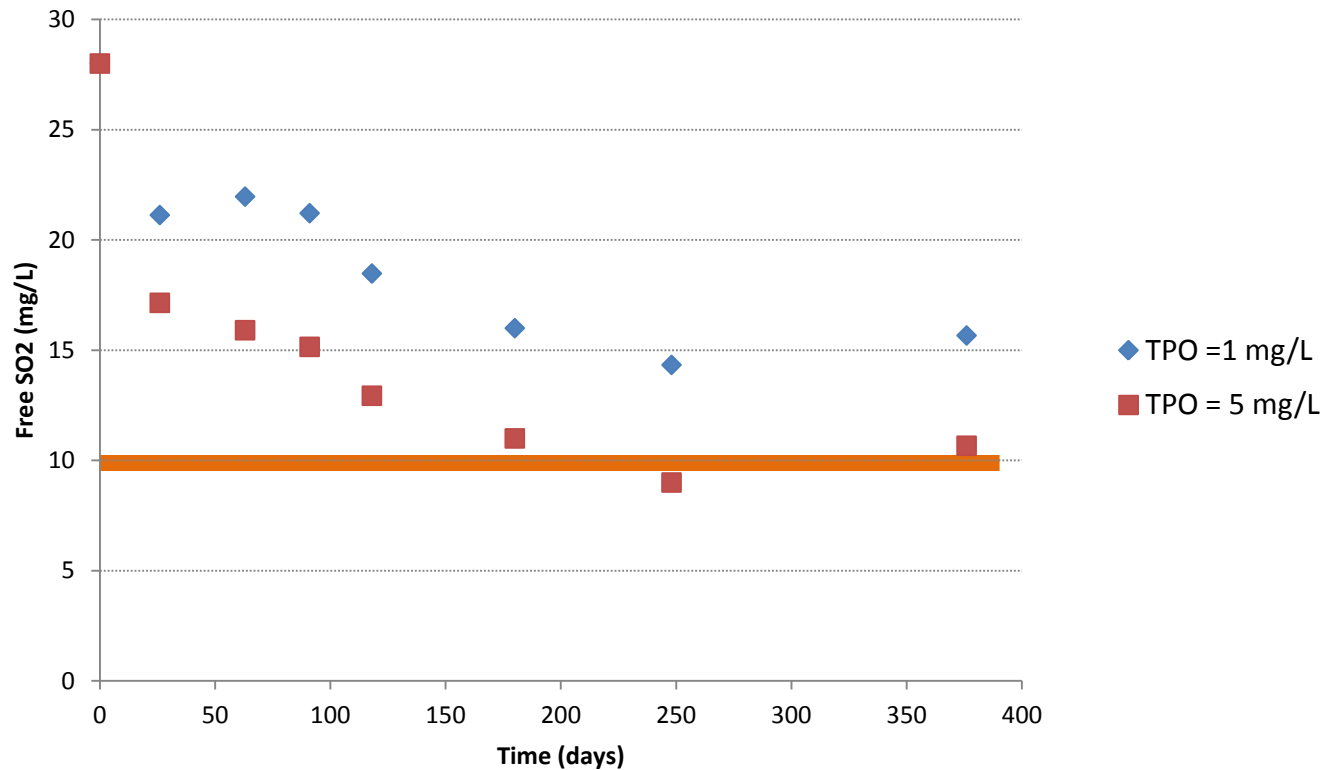


Kwiatkowski et al 2007, AJGWR



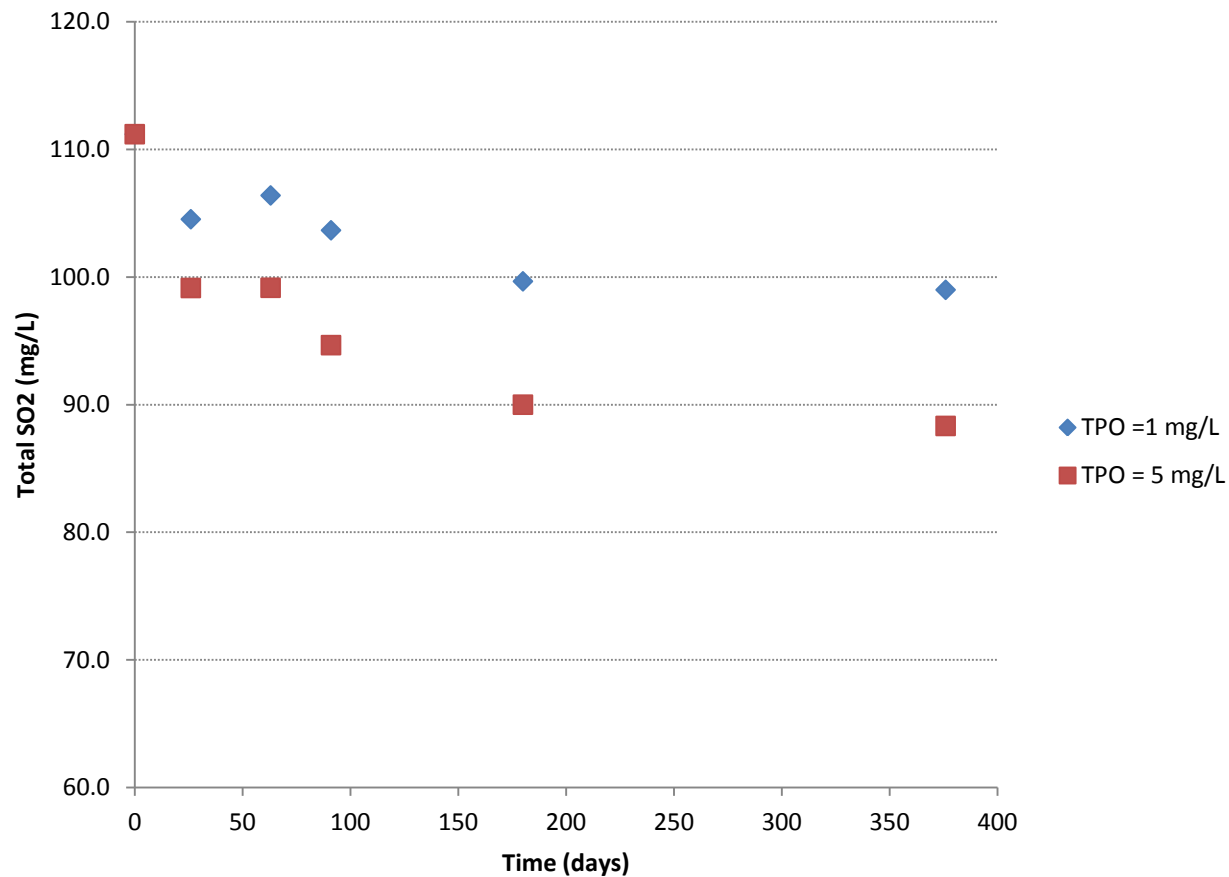
Impact of headspace oxygen

White wine controlled TPO dosing trial



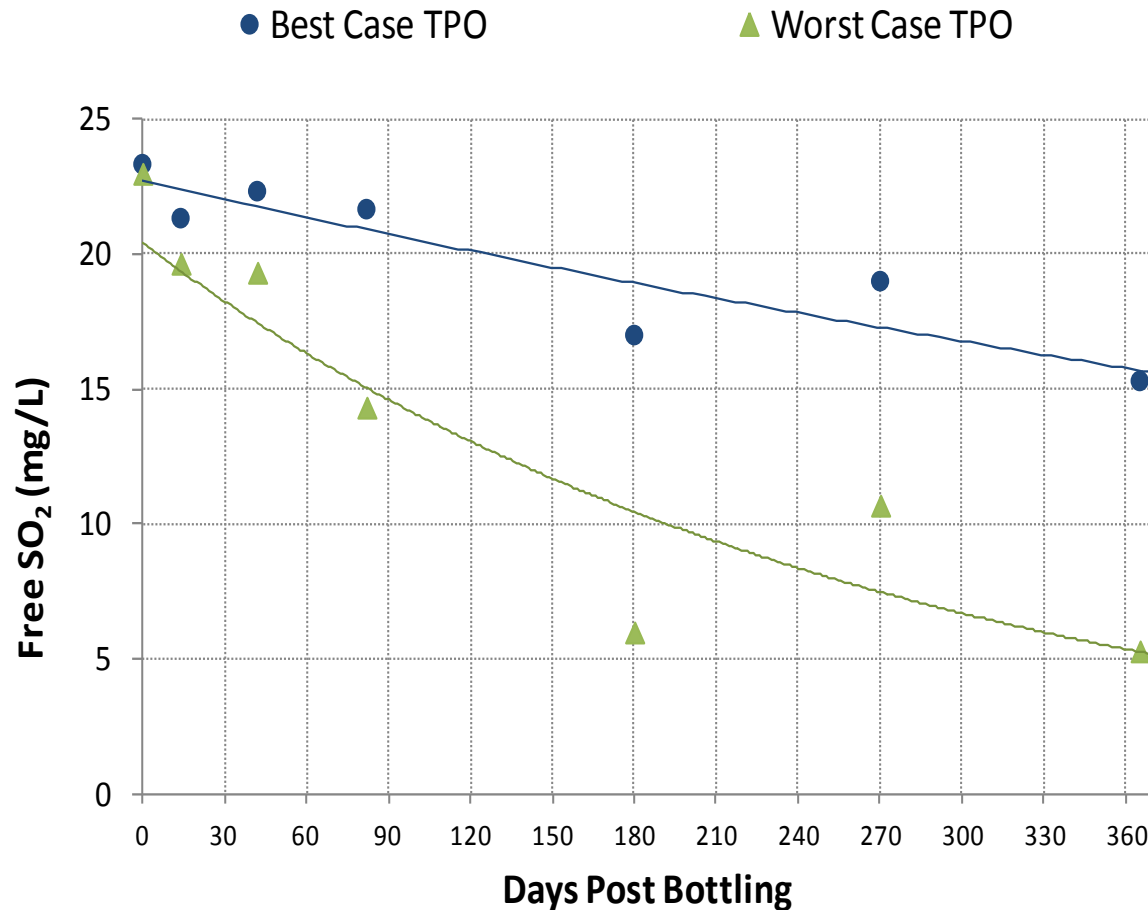
Impact of headspace oxygen

White wine controlled TPO dosing trial



Impact of headspace oxygen

Sparkling wine controlled TPO dosing trial



TPO measurement

- Still wines
 - Shaken bottle method to measure DO
 - Use AWRI calculator to convert DO value to TPO
 - Indirect measurement using oxy-luminescence (fluorescent quenching) technologies
- Sparkling wines
 - Bottle shaking may still be feasible
 - Off-the-shelf TPO analysers used by breweries
 - Customised low cost solutions using fluorescent quenching technology

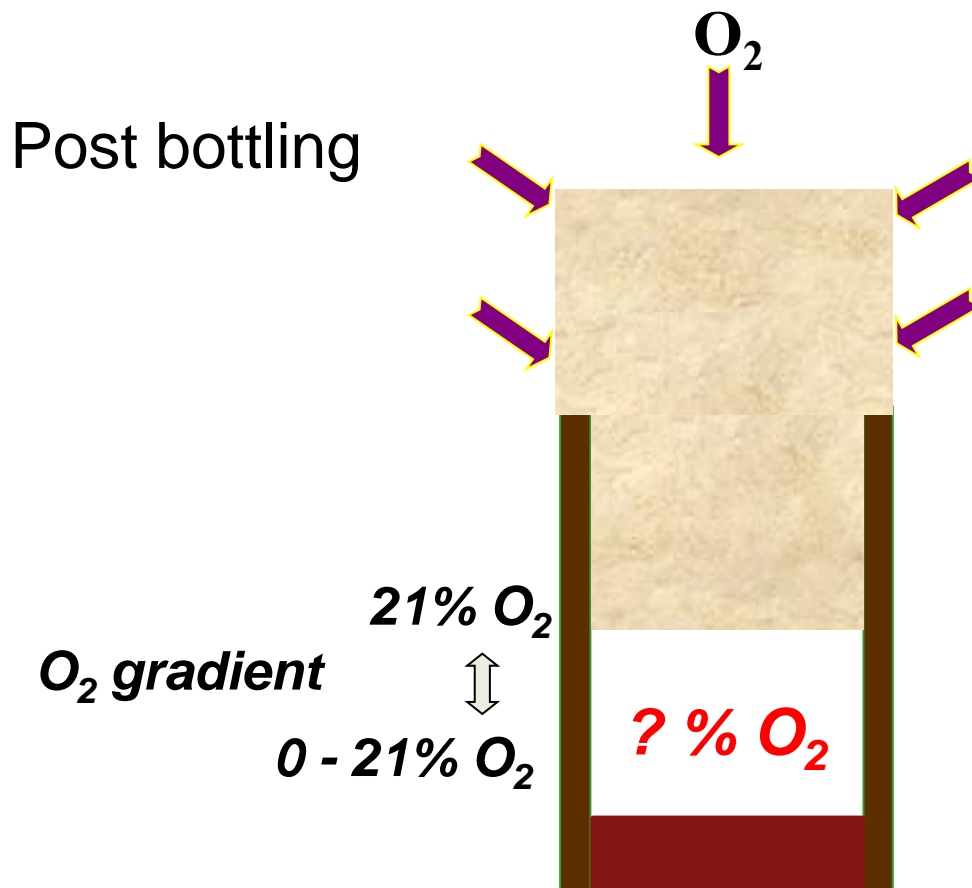


<http://www.hach.com>



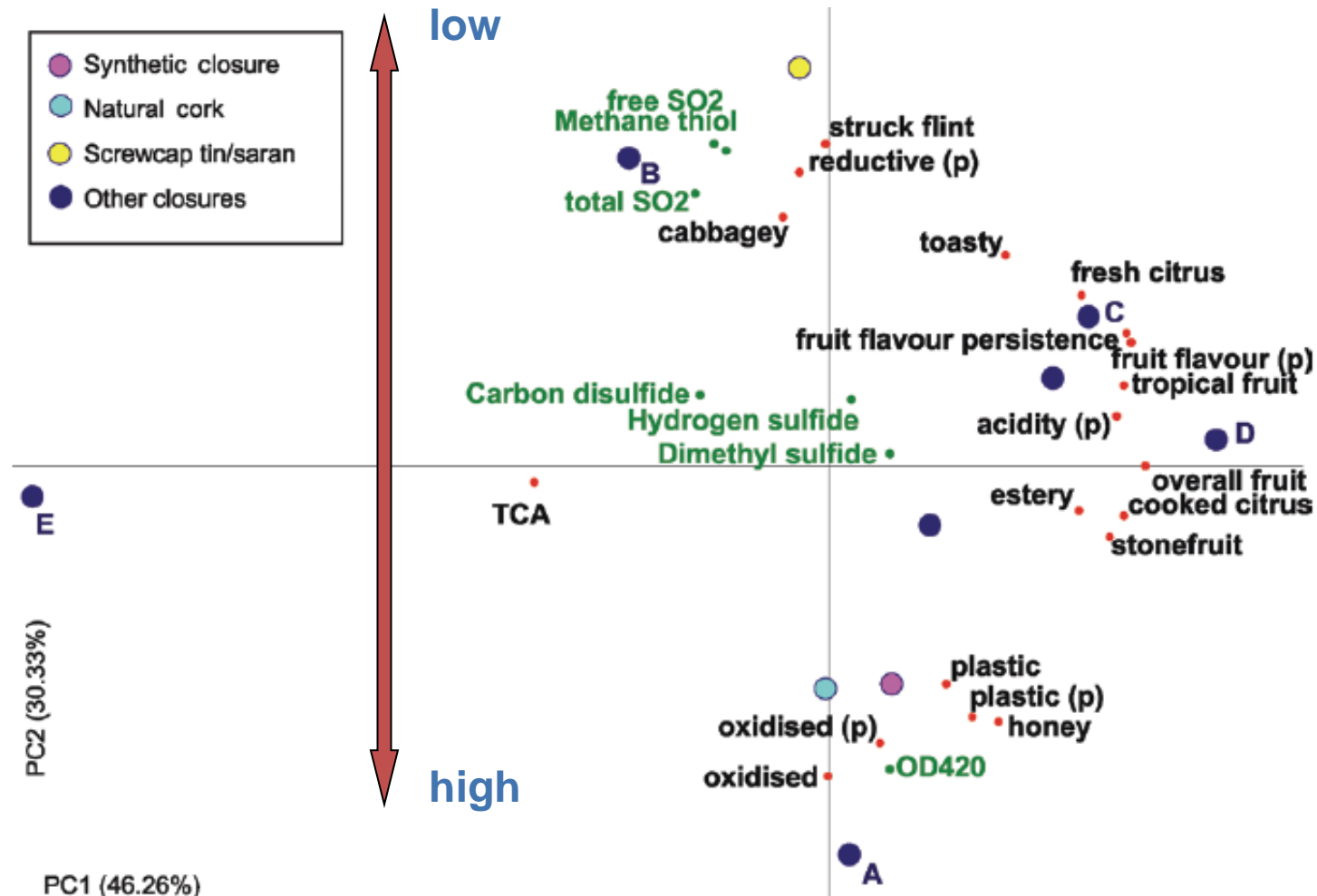
Closure Oxygen Transmission Rate

- Driven by concentration gradient and diffusion coefficient



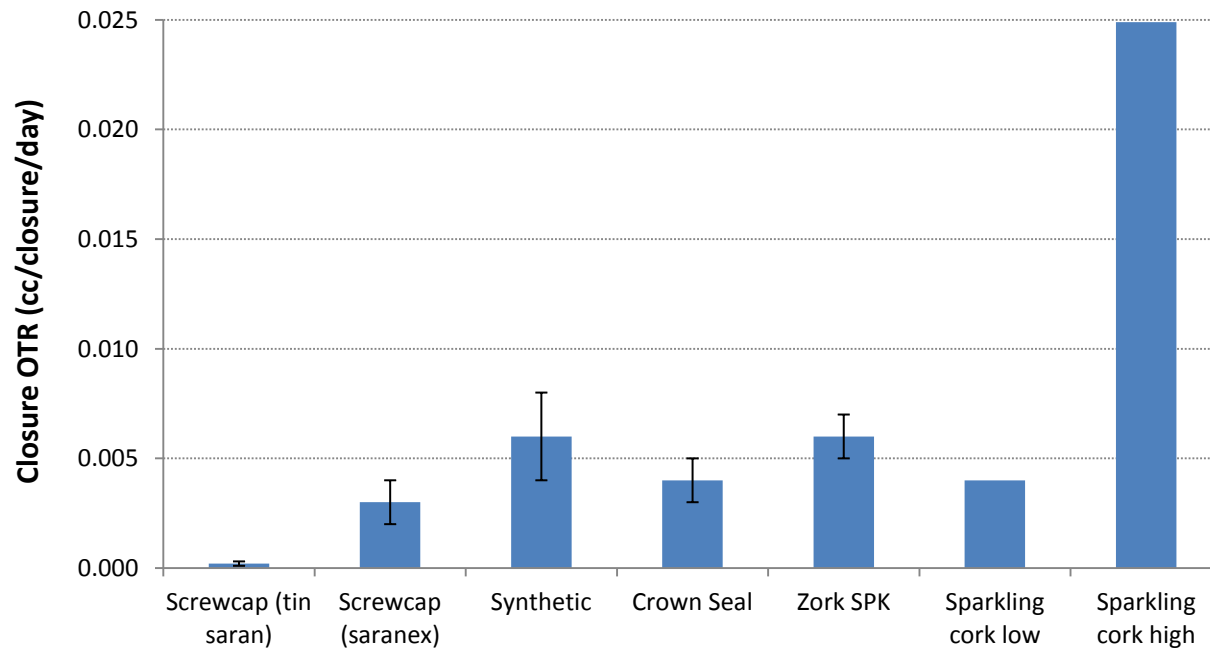


OTR matters





Typical Closure OTR's



Summary

- Measuring DO to control bottling operations is largely irrelevant – TPO is the key parameter
- Sparkling wines face even greater scope than still wines for bottling related quality and shelf life impacts
- Relatively simple operational techniques can be used to ensure the headspace is at an acceptable oxygen concentration
- Closure choice is a major influence in determining the ultimate wine style and product shelf life

