A W R I

The Australian Wine Research Institute

Benchmarking results from the oxygen management audit of a mobile bottling line

Introduction

- AWRI Commercial Services conducted an Oxygen management audit on a mobile line on Friday, 12 February 2010.

- The objective of this audit was to establish the proficiency of the mobile bottling line in controlling oxygen ingress at bottling, and to quantify the overall total package oxygen (TPO) levels

Introduction – Oxygen in wine

Where does it get in ?

- Before bottling
- At bottling
  - Dissolved in wine
  - Headspace oxygen
- Post-bottling – closure OTR

Bottle image provided by Stéphane Vidal, Nomacorc

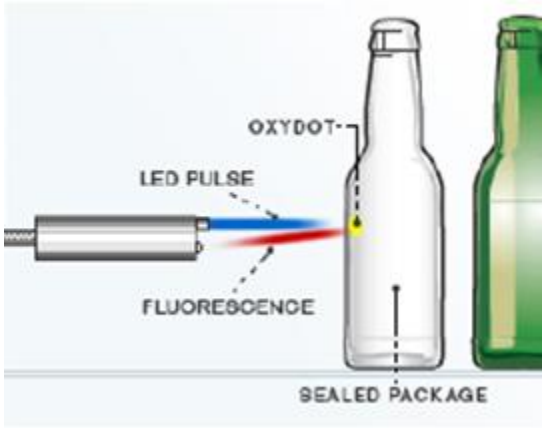
Introduction – Oxygen in wine

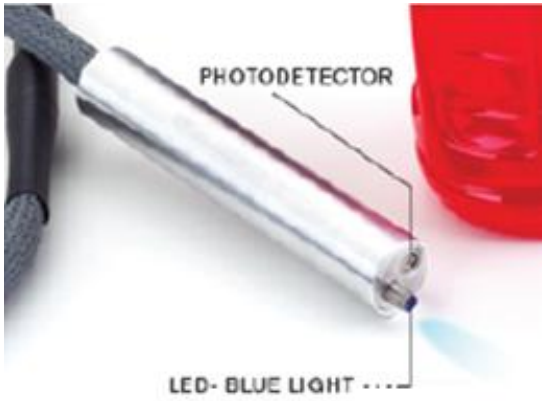
- Commonly, wineries and bottling facilities only measure oxygen:
  - In the bottling tank, prior to and/or at the commencement of the bottling run; and
  - Dissolved in the packaged wine at start-up and then regularly throughout the bottling run.

- But this only tells part of the story, as even when shaking protocols are used, not all of the oxygen is dissolved in the wine !!
- We now have the tools to quantify the total oxygen in a closed bottle.

Introduction – Oxygen in wine

- Oxygen levels are measured using 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
- This enables Commercial Services to measure oxygen both dissolved in the wine AND the gaseous oxygen in the headspace





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Applications – Bottling audits

- Measure DO of upstream tank (initial DO)
- Measure at each sampling point:
  - Before and after filters
  - Before and after pumps
  - In header tank
- Measure DO and headspace oxygen of filled bottles
- Determine the TPO as well as identify pickup points in process

Bottling

- Six short bottling runs were conducted whilst onsite, and the first three runs were audited for total package oxygen.

- Screw-cap closures were used for all runs.

- The following oxygen management practices were used:
  - Gaseous CO_2 bottle flush pre-filling
  - Gaseous CO_2 headspace flush pre-cap application

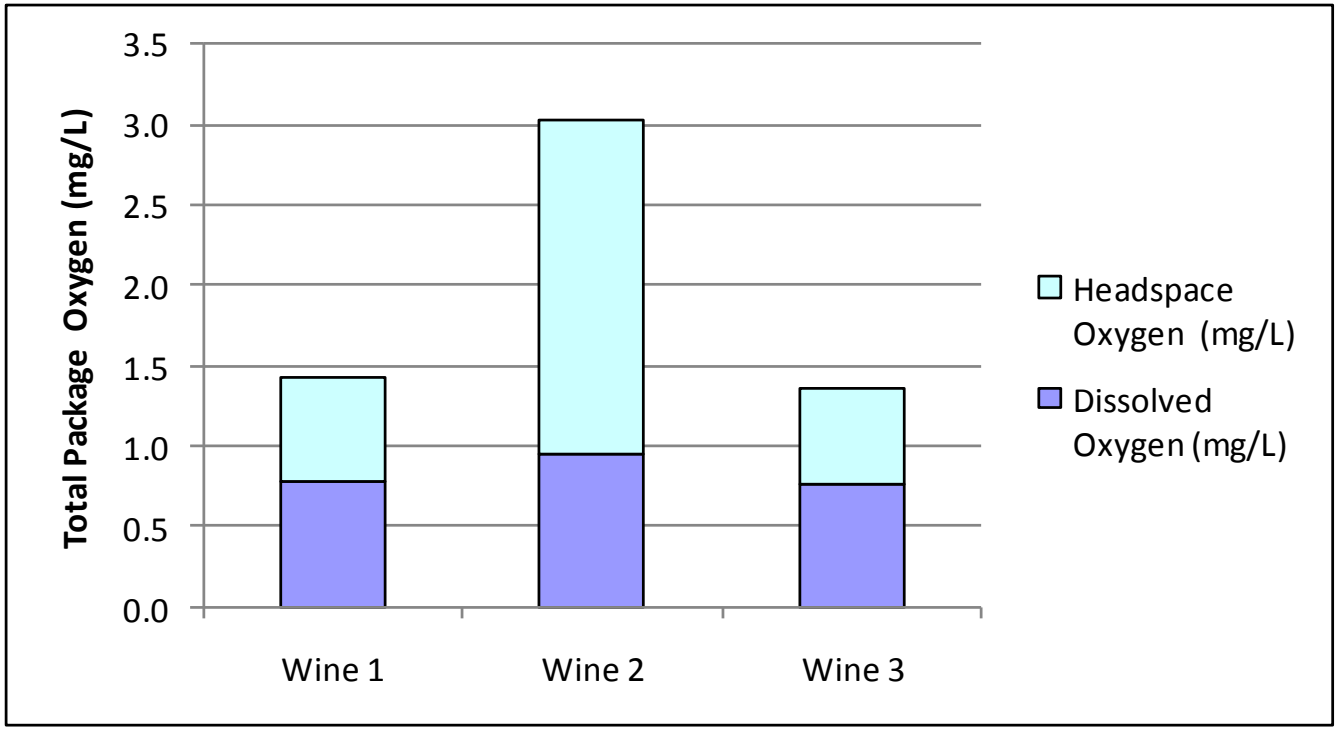
Results

Three different batches of wine were audited -

Trial	Dissolved Oxygen (mg/L)	Headspace Oxygen (mg/L)	Total Package Oxygen (mg/L)
Wine 1	0.77	0.66	1.43
Wine 2	0.94	2.08	3.02
Wine 3	0.76	0.60	1.36

- Dissolved oxygen levels were similar for all wines
- Headspace oxygen level for Wine 2 was much higher than the other wines – why?
    - The CO_2 gas cylinder pressure for the headspace flush had decreased slightly, causing a reduced flow rate of CO_2 into the bottle headspace

Results

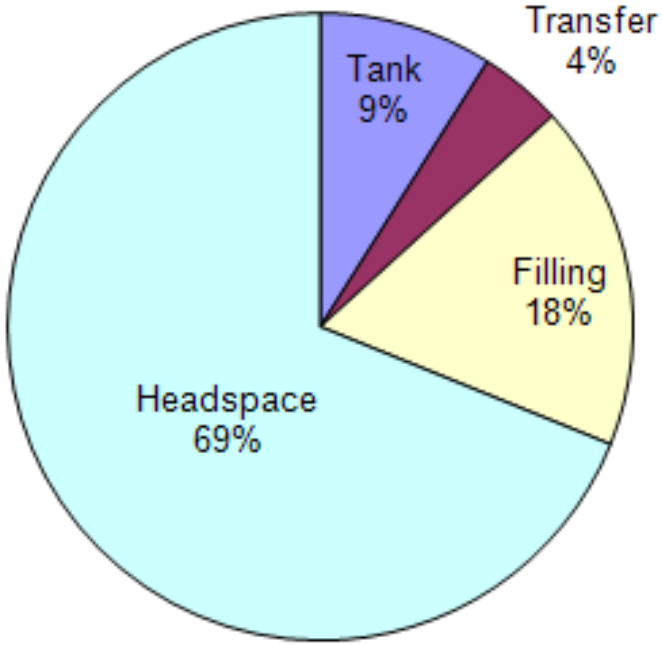


- The TPO for wine 2 is double that of wine 1 or 3
- This demonstrates that efficient headspace treatment is critical for minimising and controlling TPO !!

Results – oxygen pick -up

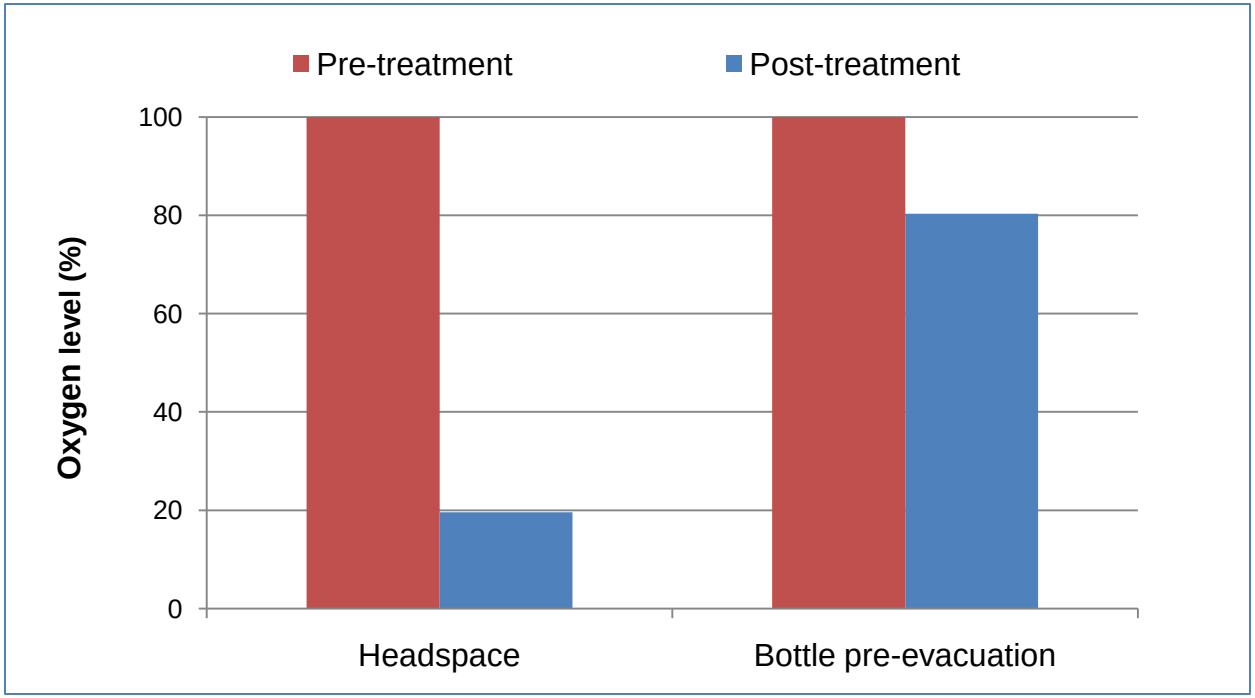
The percentage oxygen pick-up for wine 2 is highlighted by the graph

- 9% of the total oxygen was present in the tank pre bottling
- 4% was picked up during the transfer (across the pump)
- 18% of the oxygen was picked up during filling process
- 69% of total oxygen was in the headspace



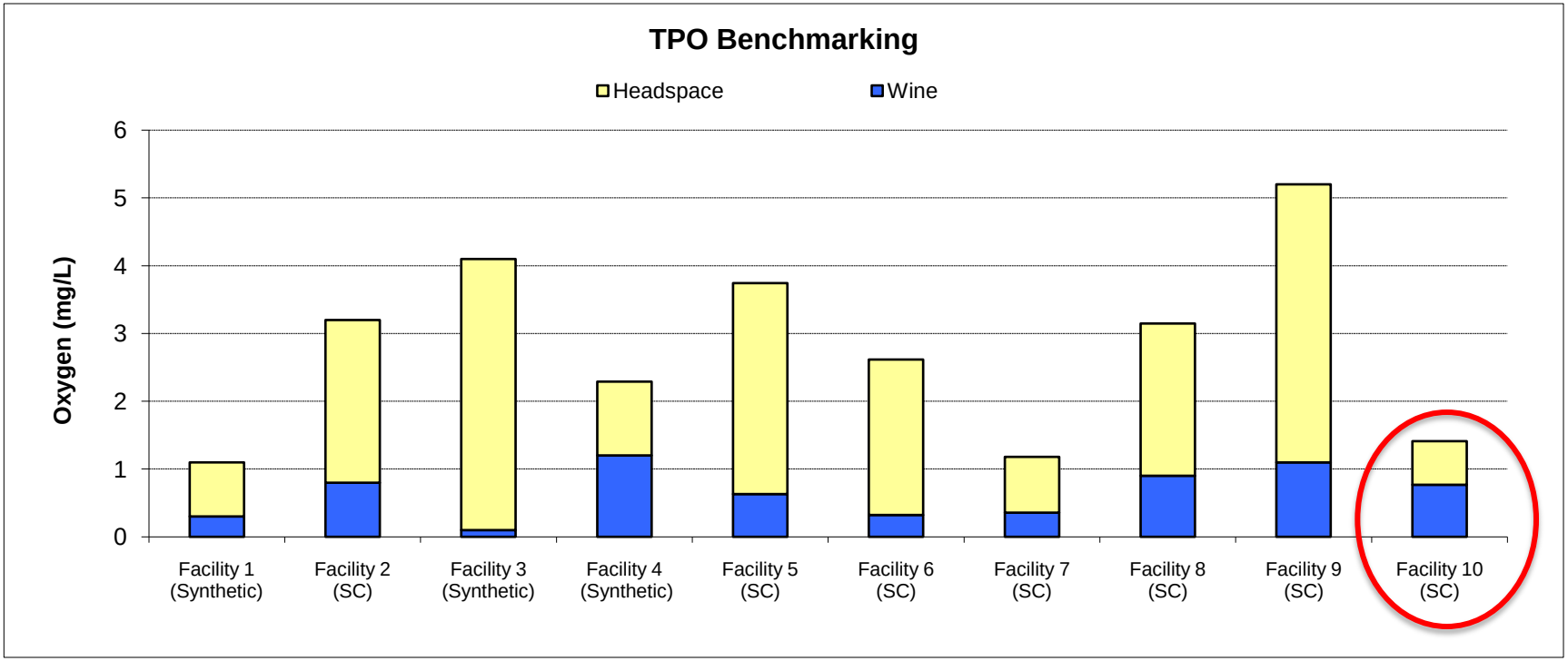
- Therefore headspace oxygen is the dominant factor !!

Results – Effectiveness of oxygen management strategies



- Headspace treatment is 80% effective in displacing oxygen
- Pre -fill bottle sparging is only 20 % effective in displacing oxygen

Benchmarking of total package oxygen at bottling



- The bottling run compared favorably with other bottling facilities
- Overall results are highly variable from facility to facility
- Generally headspace oxygen dominates

Summary

- Total package oxygen levels were below 1.5 mg/L whilst the headspace treatment was optimised.
- This result positions this bottling line in the more proficient range of all facilities audited by AWRI.
- Headspace treatment works effectively, however it is critical that this is rigorously controlled.
- Dissolved oxygen pickup can be improved through increased effectiveness of CO_2 used to flush the bottles pre filling.
- Given the total package oxygen levels were below 1.5 mg/L, it is expected that the bottling operation would have imposed a minimal sensory impact on the wines.