AWRI Report

VINOLOK (VINOSEAL) closure evaluation Stage 1: Fundamental performance assessment

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1. Introduction

AWRI Commercial Services have been engaged to carry out technical proficiency testing for a number of VINOLOK (VINOSEAL) closures (17.5mm, 18.2mm and 18.5mm) and benchmark their performance against other industry-accepted closure types.

The test program consists of three elements:

1. Fundamental performance assessment
2. Closure benchmarking trial
3. Storage and transport testing

The results of Stage 1 testing are presented in this report.

2. Materials & Methods

The fundamental performance of three VINOLOK (VINOSEAL) closures has been assessed by quantifying the oxygen transmission rate (OTR) of the closures and propensity of the Elvax seal to scalp flavour/aroma compounds from wine sealed with the closures. This assessment includes the following VINOLOK (VINOSEAL) closure diameters:

- 17.5 mm
- 18.2 mm
- 18.5 mm

2.1. Oxygen transmission rate (OTR) testing

A series of six replicate bottles were included for each closure being assessed. Glass bottle types used were:

- 17.5 mm: 750 mL Vetropack Bordeaux 325 mm OBM
- 18.2 mm: 750 mL Vetropack clear Bordeaux
- 18.5 mm: 750 mL Wiegand Bordeaux 330 mm OBM

Bottles were inerted with nitrogen gas and fitted with oxy-luminescence sensors, which allowed the OTR of the closures to be assessed non-destructively over a period of three months. All VINOLOK (VINOSEAL) closures were applied by hand. Bottles were stored at a constant 17^{o}C in darkness.

All oxygen measurements were conducted using NomaSense optical sensing technology. Oxygen levels in each bottle were measured by the attachment of a Pst6 oxygen sensor spot inside of each bottle (Figure 1 below). The oxygen level in the bottle is obtained using the NomaSense unit (Nomacorc: Zebulon, NC USA), as shown in Figure 2. The oxy-luminescence sensor emits signal intensity proportional to the concentration of oxygen present. Using the calibration data provided, the oxygen concentration can then be determined, and this enables the use of the Ideal Gas Law to convert concentration values into a mass or volume of oxygen.

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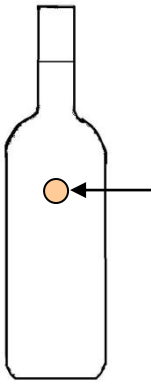

Figure 1: Placement of oxygen sensor spots

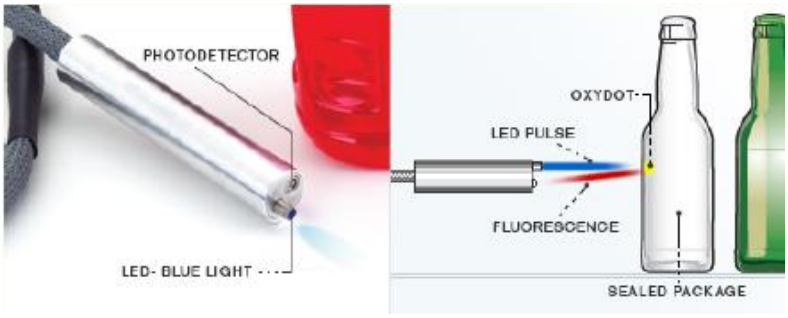

Figure 2: Measurement of oxygen using NomaSense unit

2.2. Taint and scalp testing

Although the VINOLOK (VINOSEAL) closures are manufactured from inert glass, the seal between bottle and closure is provided by a sealing ring (Elvax) made from an ethylene and vinyl acetate copolymer. The propensity of this material to scalp flavour/aroma compounds from the wine and potentially taint the wine is important, especially for delicate wines. This stage included assessment of the impact of the Elvax seal on a Semillon/Sauvignon Blanc wine spiked with known concentrations of the following typical volatile wine compounds:

Table 1: Volatile compounds added to test wine for scalping assessment

Compound	Concentration added (µg/L)
Naphthalene	100
cis rose oxide	100
trans rose oxide	100
ethyl hexanoate	500
ethyl octanoate	500
ethyl decanoate	500
damascenone	100
beta ionone	100
alpha terpineol	100
TDN	100
nerol	100
Geraniol	100
Linalool	100

The test involved exposure of the wine to the Elvax at a material: wine contact ratio of 2 x the expected level in a 750mL bottle of wine. Samples of the wine were also exposed to natural cork and Saranex (screw-cap liner) material at the same ratio. All samples were prepared in triplicate and control samples, spiked with the volatile compounds, but not exposed to closure material, were also included for comparison purposes.

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The test samples were stored at a constant 17°C in darkness for 14 days, before analysis of residual levels of the volatile compounds using gas chromatography-mass spectrometry (GC-MS). The wine samples that were subjected to the Elvax material were also assessed for the presence of taints by an expert sensory panel.

3. Results

3.1. Oxygen transmission rate (OTR)

The measured OTR results on the closures are shown below in Table 2.[1]

Table 2: OTR results for the VINOLOK (VINOSEAL) closures tested

Closure	Average OTR* (cc/day)	Standard deviation – 6 replicates (cc/day)
17.5 mm	0.0031	0.0034
18.2 mm	0.0029	0.0040
18.5 mm	0.0026	0.0021

*** OTR is measured in milliliters (mL) or cubic centimeters (cc) of oxygen (O_2) per day (24hrs)**

The performance of the three closures, with respect to OTR, is very similar, with low variability in OTR exhibited across each set of closures. Figure 1 shows OTR data taken from a commercial closure benchmarking study. Different supplier products will have different OTR ratings, but this data provides an indication of expected OTR values for different closure types.

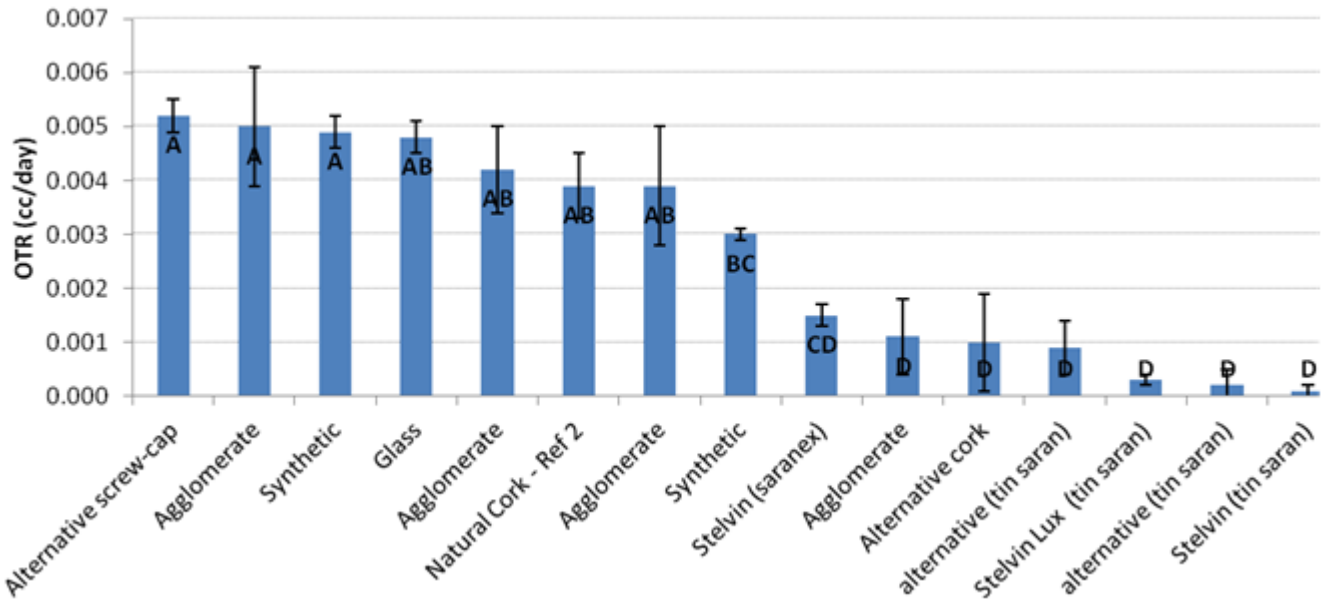

Figure 1: Indicative OTR data for different closure types.

[1] The accuracy of the oxy-luminescence sensor is quoted to be approximately 3% of the respective concentration.

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On this basis, it can be seen that the performance of the closures is consistent with OTR levels typically seen for some agglomerate (technical cork) and synthetic closures.

3.2. Scalp and taint assessment

The results below show the residual levels of each volatile compound found in the exposed wine samples, normalised to the levels found in the control (spiked) wine.

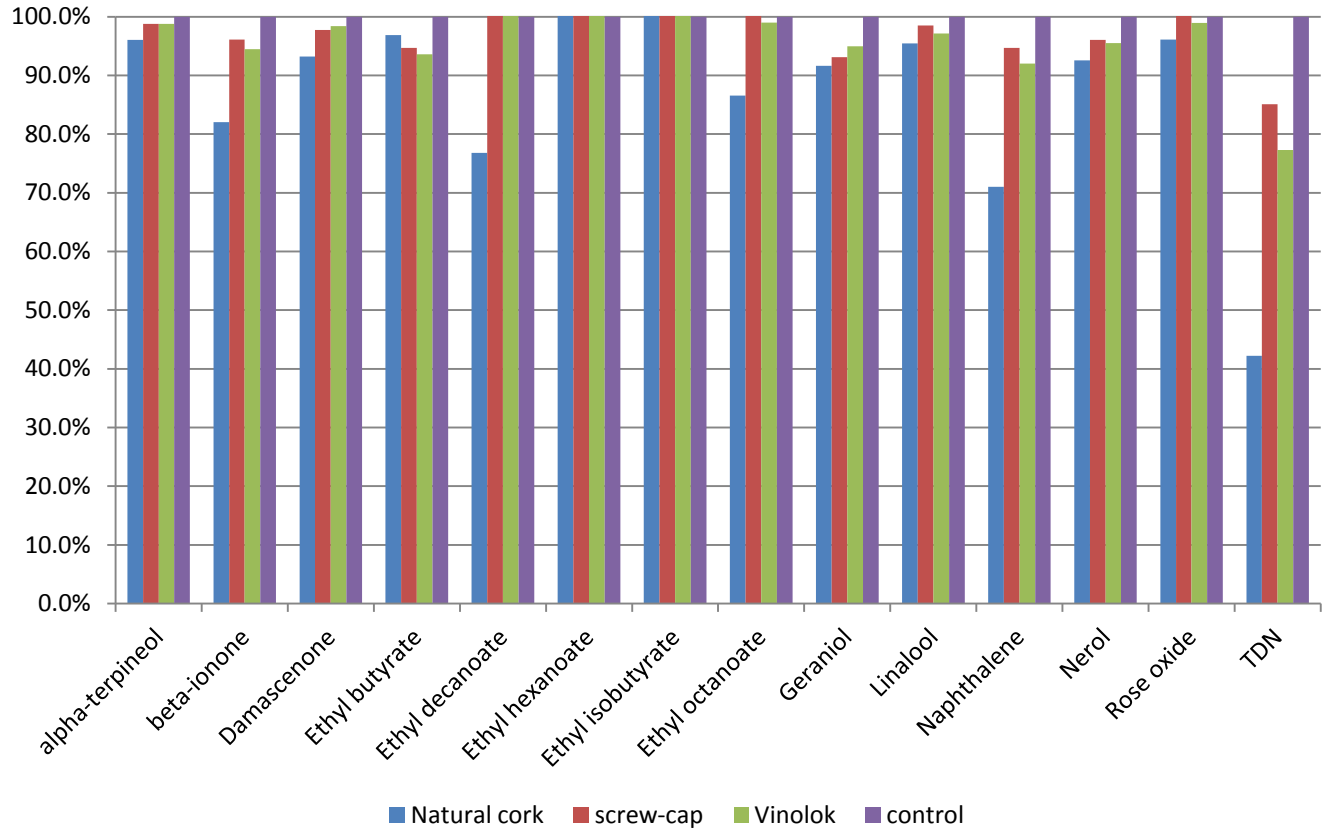

Figure 2: Residual levels of volatile compounds for Elvax, natural cork and Saranex (screw-cap) exposed wines, compared to original spiked wine (control)

For most compounds, the scalping performed by the Elvax is similar to or better than that seen with natural cork and Saranex material. The only compound scalped significantly by the Elvax material was TDN (trimethyldihydronaphthalene); this is typically associated with *kerosene*/*petrol* attributes in Riesling wines. However, this performance is on a par with the Saranex material and better than that exhibited by the natural cork.

The radar plot in Figure 3 shows the relative impact of closure material on each volatile compound tested.

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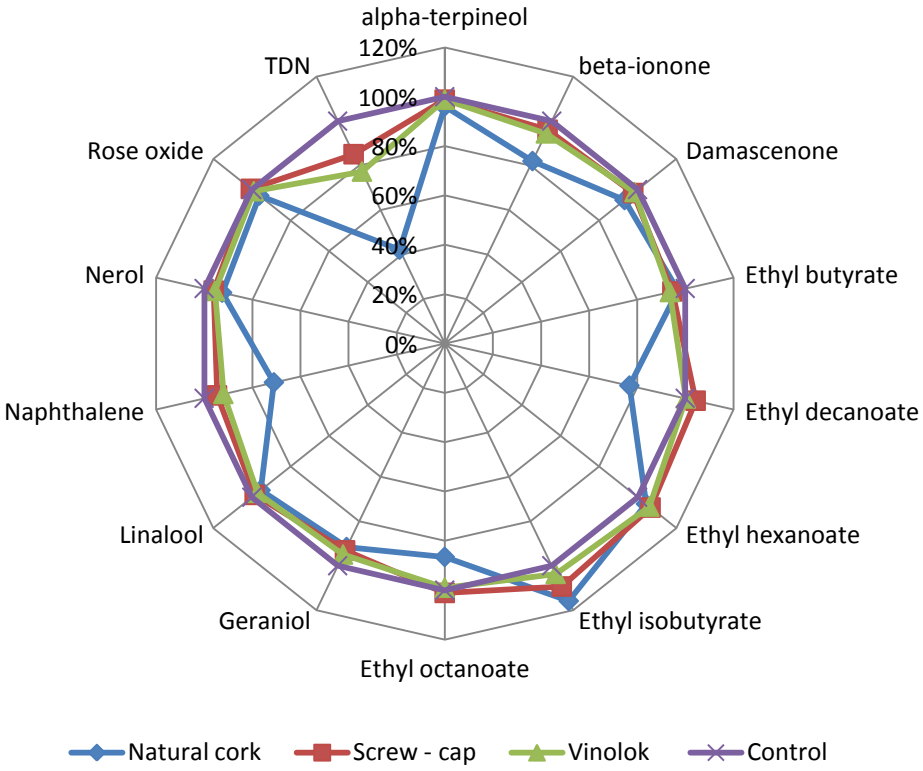

Figure 3: Comparison of the impact of closure material on volatile compounds in spiked wine

Tasting of wine samples that had been exposed to the Elvax material showed no signs of taint or spoilage compounds that could be attributed to the presence of the material itself.

4. Conclusion

All three VINOLOK (VINOSEAL) closures tested (17.5 mm, 18.2 mm and 18.5 mm) showed very similar performance for OTR with the individual bottles supplied, with OTR levels on a par with other similar closures available in the marketplace.

Taint and scalp testing showed no significant impact of the Elvax liner material, used to seal the VINOLOK (VINOSEAL) closure, on a Semillon/Sauvignon Blanc wine after exposure at double the normal contact ratio, over a period of 14 days.

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