The Australian Wine Research Institute

Fact Sheet
CLOSURES AND PACKAGING

# Flavour scalping by wine closures

## What is 'flavour scalping'?

Preservation of a food or beverage's flavour and aroma are crucial to ensuring consumer satisfaction. Some food and beverage packaging components can modify or alter the quality of the product stored. This process is sometimes described as 'flavour scalping', which refers to the ability of the packaging to absorb aroma compounds from the food or beverage.

Flavour scalping can occur in bottled wine; however, due to the inert nature of glass typically used in wine packaging, the primary material which can cause flavour scalping is the closure.

## The impact of closures on wine flavour

The flavour and aroma of a young wine is generally significantly different from that of the same wine aged over many years, primarily due to the ingress of oxygen and the chemical reactions that occur in wine over time. Ideally, a wine closure should aim to have as neutral an impact on flavour and aroma as possible, in terms of adding or removing flavour. Studies have investigated the capacity of different types of wine closures to absorb a range of volatile wine compounds including:

- Oak-related components
- guaiacol, 4-methylguaiacol, vanillin, *cis*- and *trans*-oak lactone, 4-ethylphenol and 4-ethylguaiacol
- Esters
    - Ethyl butyrate, ethyl hexanoate, ethyl decanoate, ethyl octanoate, ethyl isobutyrate

- Monoterpenes
  - α-terpeniol, beta-ionone, damascenone, geraniol, linalool, nerol, rose oxide
- Norisoprenoids
  - 1, 1, 6, -trimethyl-1,2-dihydronapthalene (TDN), β-ionone, damascenone, naphthalene.

A 2003 research trial using a bottled Semillon wine, and a similar 2014 commercial trial using a bottled Semillon/Sauvignon Blanc, assessed the impacts of different closures on volatile wine compounds over time. The original 2003 study stored wine in bottle for two years; however, changes in wine volatiles were detected over a short period of time. This led to changes in the testing method for a 2014 trial, where wine development was accelerated by storing it at higher temperatures and observing changes over a shorter period of time (14 days). For both studies, oak-related compounds were found to be chemically stable in the trial wines, with negligible decreases observed over the trial period.

Short-chain esters were also generally unaffected by closure; however, larger sized esters were more readily adsorbed at varying levels by different closures. In the 2003 study, the screw cap (saran/tin) showed similar concentrations of all volatile esters to that of the wine sample stored in the glass ampoule over the same period, suggesting that this closure was not scalping these compounds. The screw cap (saran/tin) was thus used as a reference closure in the 2014 trial. In both trials scalping of esters was seen for natural, technical and synthetic closures, as ester chain length increased, with the natural corks showing the lowest levels of absorption and the synthetic closures showing the greatest (Figure 1).

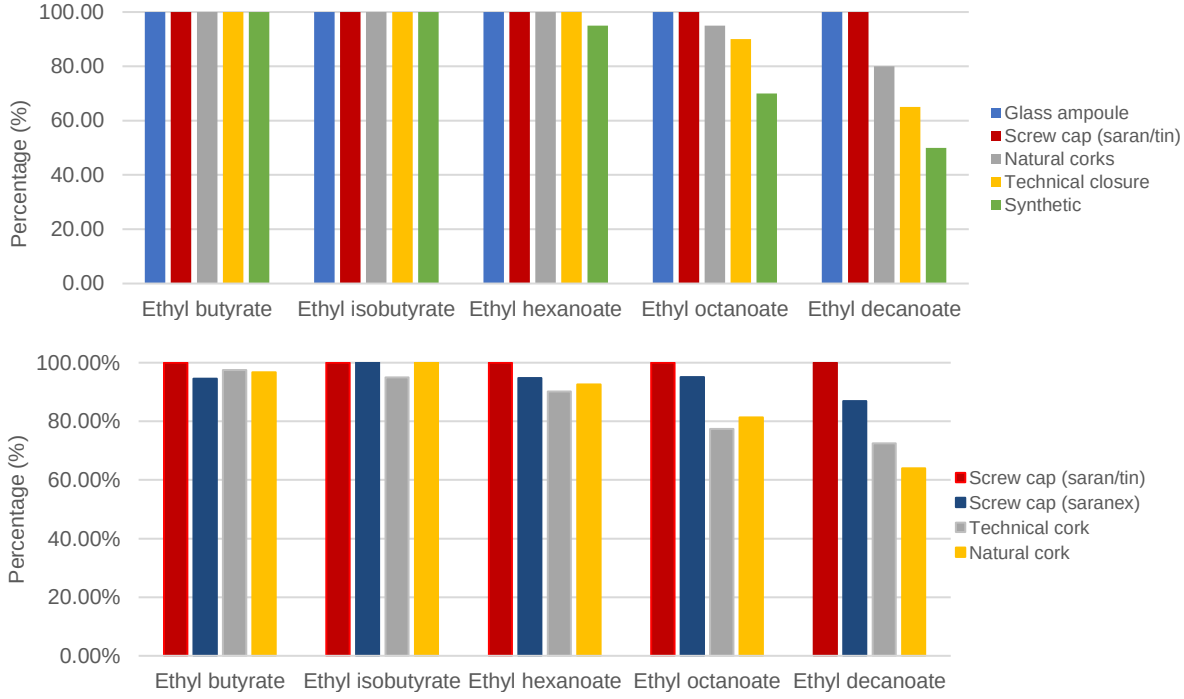


*Figure 1. (Top) 2003 research trial showing proportions of ethyl esters remaining in a Semillon stored in 750 mL bottles sealed with various closures for two years, and (bottom) 2014 commercial trial showing proportions of ethyl esters remaining in a Semillon/Sauvignon Blanc stored in 750 mL bottles sealed with various closures at 28 °C and analysed 14 days after bottling.*

While bottle closures play a part in the changes that occur in wine over time, the overall modification of flavour and aroma that occurs in-bottle is also a result of complex wine-specific chemical and (sometimes) microbiological transformations. Figure 2 shows the change in a series of monoterpenes observed in a Semillon wine stored in a glass ampoule for two years; that is, with no packaging interference or ingress of oxygen. The results demonstrate that chemical modification of a wine takes place irrespective of how the wine is sealed. These modifications can also be variable from one wine to another.

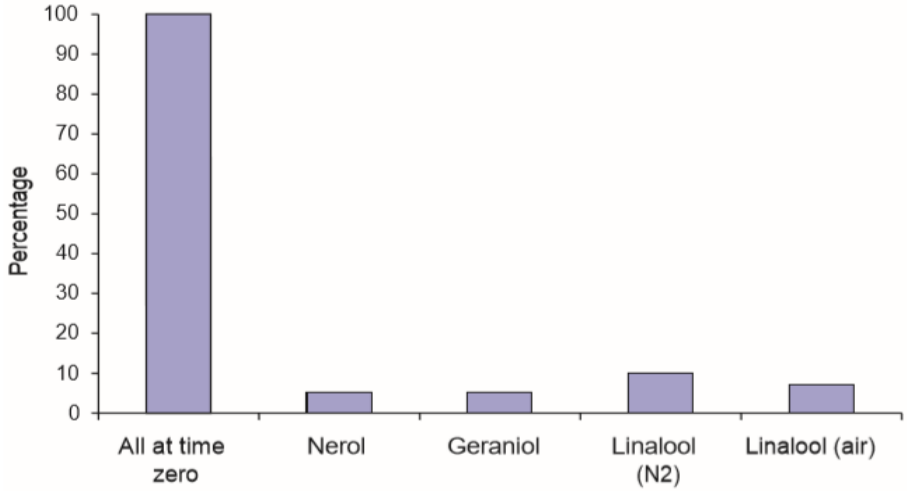


*Figure 2. Proportion of monoterpenes remaining in white wine stored in sealed glass ampoules for two years. Proportions are a percentage of the concentration of the monoterpenes at the time the ampoules were sealed (time zero).*

## Contact

For further information on flavour scalping, please contact:

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## Reference

Capone, D., Sefton, M., Pretorius, I. and Hoj, P. 2003. Flavour 'scalping' by wine bottle closures - the 'winemaking' continues post vineyard and winery. *Aust. N.Z. Wine Ind. J.* 18(5): 16, 18-20.