

Orientation and temperature cycling impacts on the oxygen transmission rate of wine closures



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Introduction

- The oxygen transmission rate (OTR) of a closure can have a significant impact on the shelf life of a wine.
- Throughout the supply chain, orientation and storage conditions can differ considerably, due to specific distribution, export and warehouse conditions, or simply position on the shelf in-store.
- Understanding the impact of orientation and storage environments on the OTR of commercial closures could prevent the early onset of oxidation, ensuring that wines reach the consumer in their intended state.

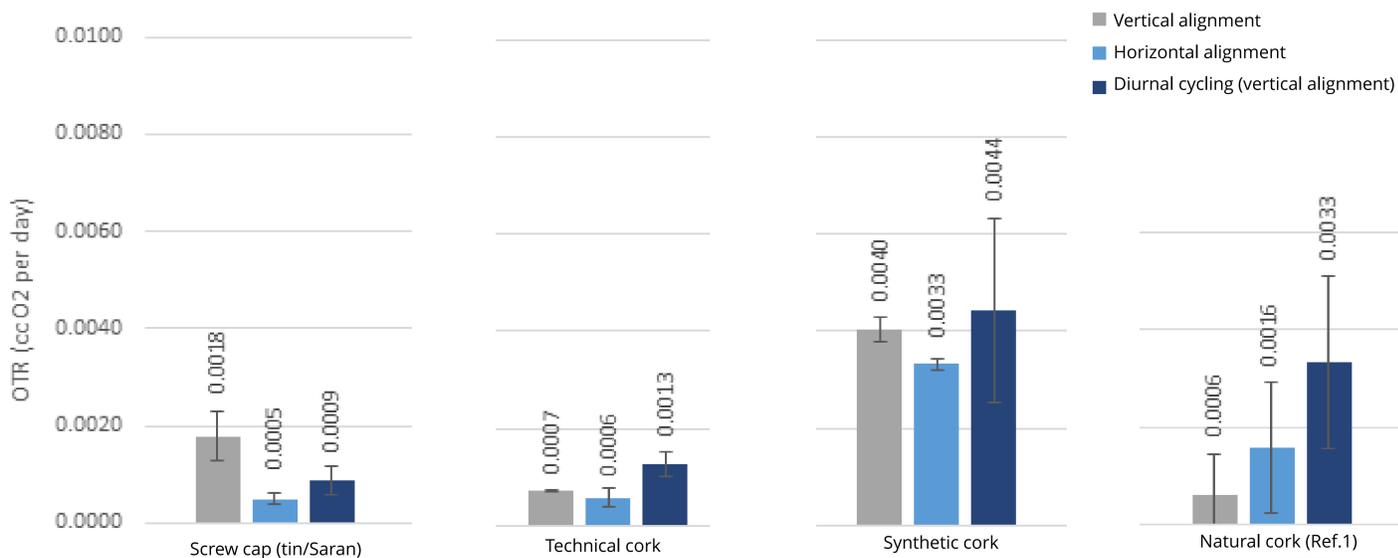
Materials and methods

- The OTR was evaluated of a series of four commercial closures (screw-cap [tin/Saran], high grade technical cork, synthetic cork and natural cork [Ref.1]) using the AWRI proprietary wet OTR method, stored at 17°C both vertically and horizontally.
- A replicate set of samples was stored vertically and subjected to diurnal temperature cycling (17°C - 28°C) on a daily basis for a period of three months.
- A **diurnal cycle** is any pattern that recurs every 24 hours as a result of one full rotation of the Earth around its own axis



Results and discussion

- **For all closures subjected to thermal cycling, elevated OTR values were observed**, compared to those stored vertically and horizontally at 17°C. Diurnal cycling also increased variability among replicates, especially for the synthetic and natural cork variants.
- The technical closure showed consistent OTR values independent of the storage position, while the screw cap closures appeared slightly better suited to horizontal storage.



- The natural cork closure set showed increased variability due to diurnal cycling, with OTR double that observed through horizontal storage.
- The best performing natural cork (vertical storage) showed OTRs comparable to screw cap and technical cork.
- The synthetic closures exhibited high, but consistent OTR, with a slightly lower OTR when stored horizontally. Variability increased significantly with diurnal cycling.

Further work

- Establish OTR distribution for each closure type with larger sample sets, to understand upper and lower OTR limits.
- Investigate the impact of other factors such as humidity and prolonged temperature exposure on OTR.
- Evaluate additional closure variants to understand OTR variation for different cork grades and screw-cap liner materials.



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