Preventing Oxygen Ingress During Wine Bottle Closure Trials

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Long term trials are often carried out to assess the oxygen barrier properties of different wine bottle closures. At the commencement of these trials, bottles are filled with the same wine under the same conditions and sealed using different closures. Analyses are then carried out at fixed time points (e.g. 1, 3, 6, 9 12 months) after bottling to evaluate changes in the wine that are induced by reactions with oxygen – loss of sulphur dioxide, loss of ascorbic acid and generation of brown colour.

In these trials, it is often difficult to differentiate between the impacts of oxygen that has been incorporated into the pack at bottling (dissolved oxygen in the wine, oxygen included in the bottle headspace gas and oxygen contained in the closure) and oxygen that enters the bottle through the closure after the bottle has been sealed. To assess the relative contributions of these sources of oxygen, it is necessary to include negative controls in the trial. These bottles are filled and sealed under identical conditions to the test bottles, but are treated after sealing to prevent oxygen entry through the closure. Testing of negative controls should be carried out at each time point throughout the trial.

In the past, a number of techniques have been used to prevent oxygen entry through inserted closures (corks, synthetic closures) during long term trials. The Australian Wine Research Institute covered the tops of inserted closures with epoxy glue soon after bottling (AWRI Annual Report 2001). The Chambre d'Agriculture de Gironde covered the tops of closures with wax in a closure study reported in 2004 (C Chassagnou, pers.comm.). Waters and Williams (1997) used bottles with a screw cap neck finish. After closure insertion, high barrier screw caps were applied to bottles selected as negative controls.

An easily applied seal that provides an effective barrier to oxygen transfer through inserted closures has recently been developed. The technique uses epoxy glue and standard 50 mm diameter laboratory watch glasses. The following steps are used:

1. Wine is filled into bottles using normal commercial techniques.
2. Closures are inserted so that the top of the closure is 1-2mm below the bottle rim.
3. The top of the neck rim of bottles selected as negative controls is lightly abraded with sandpaper to ensure that it is clean and slightly roughened.
4. Two pack epoxy glue with a thick consistency (such as Araldite or Epiglue) is mixed and placed on top of the closure, and on the rim of the bottle.
5. A 50 mm watch glass is placed over the neck of the bottle and pressed downwards. The watch glass is placed so that the convex surface is in contact with the bottle rim.
6. Glue movement is observed through the watch glass to ensure that there is a complete glue seal between the bottle neck and the watch glass.
7. The bottles are left upright until the epoxy glue has cured.

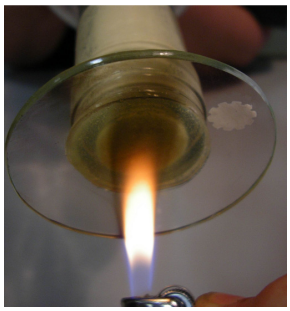
8. At the time point at which testing of the wine in the bottle will be carried out, heat is applied to the upper surface of the watch glass using a gas flame or hot air gun until the epoxy glue softens. The watch glass can then be removed from the bottle.
9. A corkscrew can then be used to remove the closure in the conventional manner.

This technique can also be used to provide negative controls during oxygen transfer rate testing of inserted closures using luminescence systems such as PreSens and Oxysense. The use of secure negative controls ensures that clear differentiation can be made between oxygen already in the bottle and closure at the time of sealing and oxygen that enters the bottle through the closure after sealing has been carried out.

Closure inserted into the bottle neck

Closure and bottle rim covered with epoxy glue

Watch glass applied to bottle rim



Gas flame applied to the watch glass

References:

Australian Wine Research Institute Annual Report (2001): 29-31

Waters E and Williams P (1997) The Role Of Corks in the Random Oxidation of Bottled Wines Australian Wine Industry Journal 2: 189-193