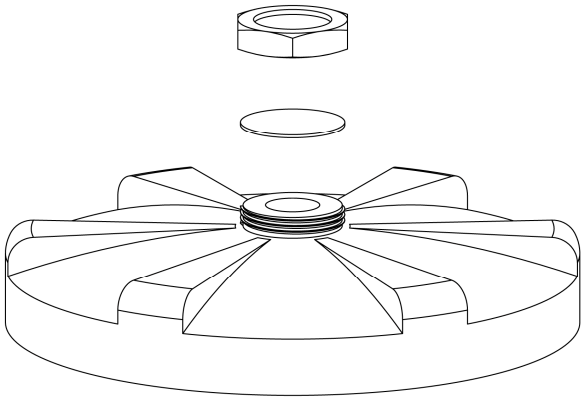
2009 RedOaker Field trials-Stage 1

RedOaker MS 980 units were filled with a 2008 Clare Valley Cabernet undergoing MLF whilst containing French and American oak staves. Units were left with approximately 12lts of ullage by volume above the wine surface; the gas space was then purged with argon leaving a 02 content of 1%-2% and sealed. The permeability of the upper membrane (illustrated right) used in the trials is calibrated at 50ml/02/24hr (approx 20ml/lt/yr) under normal atmospheric conditions (1 atm), temp range 10-16 deg.c.



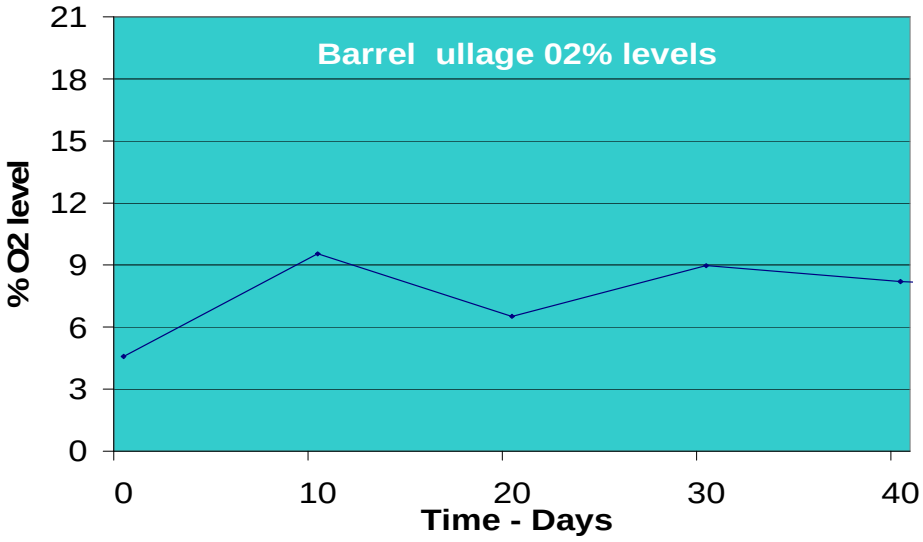


Figure A is a representation of figure 6a page 137; in the publication "Journal des Sciences et Techniques de la Tonnellerie 1998, Gaseous exchange in wines stored in oak barrels", illustrating the oxygen content of the ullage space above the wine surface in oak barrels. The authors explain "The proportion of oxygen measured over 10 days was between 5% and 9%, and always remained within this range and relatively stable over the observation period. Other occasional measurements taken in cellars globally confirmed the results indicated in figure 6a."

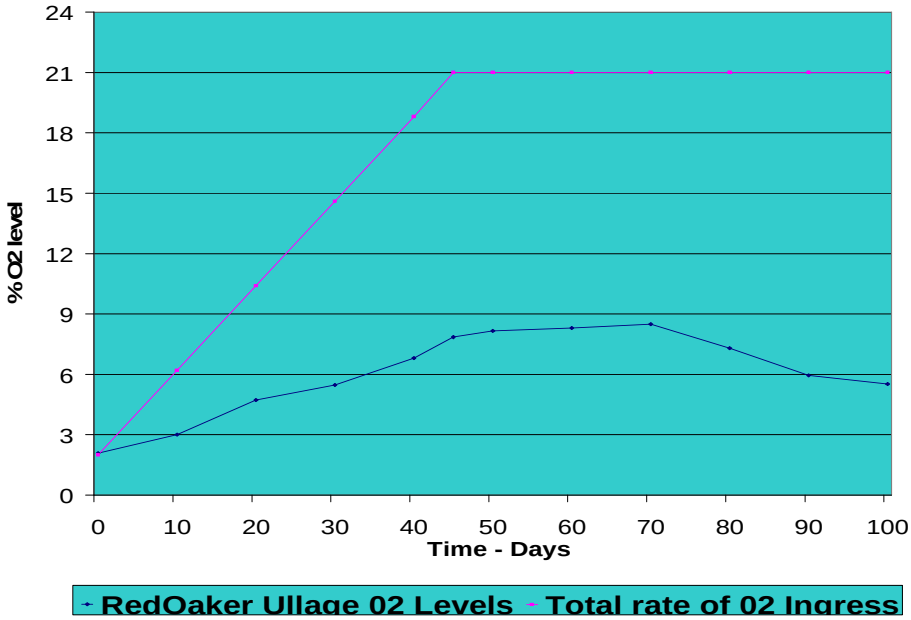
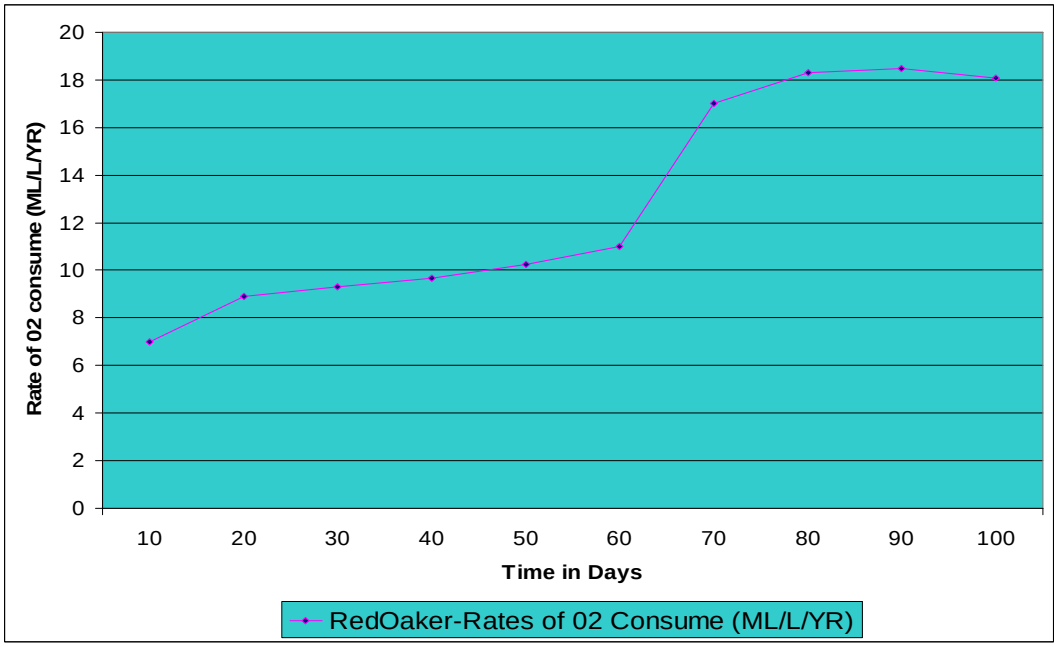


Figure B; illustrates progressive levels of oxygen in the ullage space of the RedOaker MS 980 incorporating a gas permeable membrane and the actual rate of oxygen ingress. The "Total rate of 02 Ingress" shows the known rate of oxygen permeation through the gas permeable membrane until atmospheric equilibrium is achieved (20.9%). The discrepancy between this rate and that found in the RedOaker units can reasonably be considered as the rate at which available oxygen is consumed in oxidative reactions with the contained. In comparison to Graph A (oak barrels) it can be seen ullage 02 levels were generally lower in the RedOaker vessel over the same period (40 days average 02, 4.75%) and steadily increased to approx 8.5% over 70 days after which 02 percentage dropped to approx 5.5% after 100 days.



Stage 1-In Summary

Stage 1 Field trial results show the RedOaker Modular Storage units, when used in conjunction with calibrated gas permeable membranes, will effectively duplicate the manner and rate of 02 ingress shown to occour in correctly functioning oak barrels by (Ribereau-Gayon 1931, Moutoutnet 1998).

Both Nitrogen and Argon were employed as inert ullage purging gases in the field trials, oxygen consumption rates over the trial period proved to be similar in both circumstances.

Figures 6b and 6c show initially slow and continual increase in the rate of oxygen consumption relative to the rate in which oxygen is known to permeate the upper membrane and enter the ullage space. This maybe explained by other avenues of 02 exposure other than that which permeates through the membrane. In this regard consideration should be given to 02 exposure during initial filling/racking and resultant levels of dissolved oxygen, and in particular, the initially rapid displacement rate of 02 from immersed, dehydrated oak staves near and below the wine surface. Thus, in this circumstance, with regard to oxygen exposure and consumption, the introduction of a GP membrane may be unnecessary in earlier stages of storage/maturation.

Oxidative Spoilage.

Particular attention was given to the potential for wine spoilage. It is well known "excessive" 02 exposure result in oxidative faults, viable populations of acetic acid bacteria and brettanomyces. Although species of the acetobactor genus are considered strictly aerobic they have shown survival potential at low 02 concentrations. (Du Toit 2008). However it is considered if the oxidative conditions found in correctly functioning oak barrels are duplicated in the RedOaker vessels, the potential for oxidative faults (in the RedOaker vessels) would be significantly less. Unlike oak, the tightly interspaced melolecular structure of the RedOaker polymer walls do not permit liquid sorption and in consequence are an unfavourable environment for microbial viability. Further, wine in the RedOaker vessels is protected by a constant presence of over 90% Argon, (having a greater specific gravity than oxygen) by volume in the ullage space preventing "excessive" oxygen exposure. Free sulphurs were monitored with typical dosages inline with the oak barrels employed as control. Dissolved oxygen levels remained below .5ppm.

The accurate control of oxygen ingress rates and free sulphur levels at the molecular level in combination with purging the vessel headspace of oxygen with argon proved an effective method of maturation while avoiding excessive oxygen exposure. Oxygen exposure in the RedOaker units is shown to be similar to that of new oak barrels (in this case approx 20ml/lt/yr or 28mg/lt/yr).

None of the wines resulting from the RedOaker stage 1 field trials exhibited characteristics or wine faults consummate with excessive oxygen exposure or microbial spoilage.

2009 RedOaker Field Trials-Stage 2

Stage 2 involved trials with the introduction of subsurface membranes as illustrated below. In this instance oxygen ingress through the membrane is calibrated at 45ml/lt/yr.

The illustration shows a method/apparatus for introducing controlled amounts of oxygen into wine through a gas permeable tube submerged below the wine surface.

The permeable tube is sealed at the lower end with the upper end fastened to an impermeable tube that penetrates through the head space above the wine surface and through the lid or upper surface of the wine containing vessel.

The permeable tube has an opening at the top end where it is exposed to atmospheric conditions and allows the passage of gases in and out of both the permeable and impermeable tubes.

The impermeable tube is fastened and sealed to the lid or out side of the vessel.

It is am important feature of the claimed invention that the ingress of atmospheric oxygen into the tube is at a rate greater than that which oxygen may permeate through the lower permeable section of the tube into the wine mass. Thus the oxygen content of the tube remains essentially equal with that of the prevailing atmospheric conditions. This feature allows the apparatus to introduce oxygen into the wine mass at suitable rates for the maturation of wine without pressurising the tube or the requirement of oxygen to be driven through the tube by mechanical metering means as is the case with prior micro oxygenation apparatus.

The impermeable tube is preferably made of stainless steel.

Advantages

Having the permeable tube submerged under the wine surface prevents oxygen building up in the headspace of the wine vessel. High levels of oxygen in the headspace can encourage the cultivation of acetobactors on the wine surface which in high populations can result in wine spoilage.

The amount of oxygen ingress may be varied by adjusting the wall thickness and/or surface area and/or length of permeable tube to compensate for varying capacity wine vessels and the wines potential to consume the oxygen through oxidative reactions.

The apparatus may be adapted to be used in many types of wine storage vessels including polyethylene, stainless steel and oak barrels. In the case of oak barrels the impermeable section of the tube may fit into and pass through the upper sealing bung.

Unlike of other forms of micro oxygenation the apparatus does not require oxygen to be pumped through the tube by means of an elaborate and precise mechanical metering apparatus. Such apparatus requires a power source to introduce optimal amounts of oxygen to wine for the purpose of

controlled maturation. Any failure of this apparatus or the power source can have disastrous consequences. Further such apparatus requires a tube to transport oxygen or air from the metering apparatus to vessels storing wine. It should be appreciated that when smaller vessels are stacked in high density with each vessel having its own supply tube the potential for varying rates of metered oxygen ingress into individual vessels is limited. Further and where in the vessels are in a stacked arrangement the supply tubes must be removed before the vessel can be moved, this procedure may be required to occour at considerable height and limits accessibility.

Independent laboratory analysis and tastings will be conducted periodically with results to be posted on this site. If you would like to be contacted as these results come to hand or are interested in a final tasting we invite you to provide your prefered contact details and we will keep you informed.