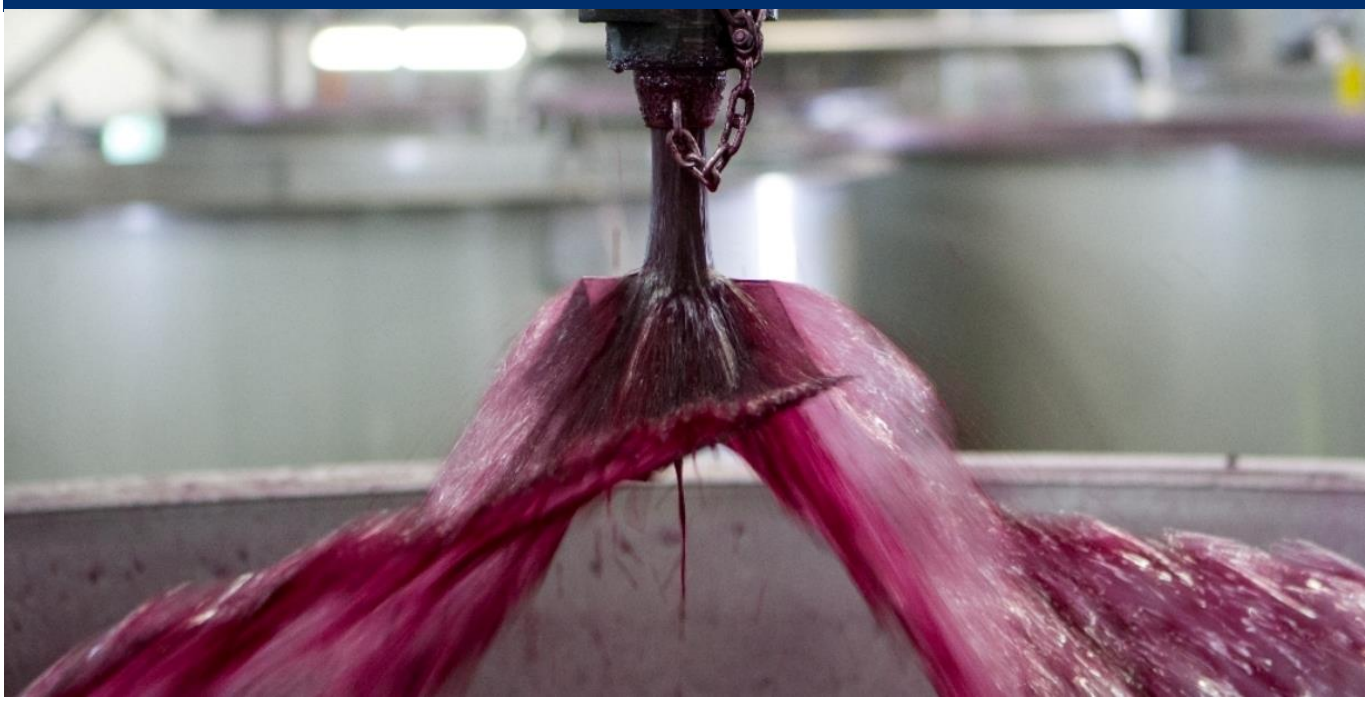
The Australian Wine Research Institute

Fact Sheet
WINEMAKING

Ways to introduce oxygen into an active red ferment



Background

Aeration during red fermentations can contribute to winemaking by:

- Improving yeast health
- Decreasing reductive aromas
- Modifying phenolic compounds in wine.

This fact sheet covers the basic steps for winemakers to get started with aeration.

Scope: who is this information for?

This fact sheet will be most useful to those who use open-top fermenters such as Potters and SWAPs. Rotary fermenters may require additional engineering to implement aeration of ferments and are therefore beyond the scope of this fact sheet.

Methods of aeration

Two methods of aeration are covered in this fact sheet:

- In-line devices (venturi or in-line sinter)
- In-tank devices (sinters)

In-line aeration during pump-over based cap management operations is an efficient approach to aeration because both operations require the pump. Combining cap management with a venturi air delivery device can help to minimise costs because a separate air supply is not needed. An in-line sinter requires attachment to a compressed air supply.

If pump-overs are not used to manage the cap or there is a preference to decouple aeration from cap management, then a drop-in or fitted in-tank sinter is worth considering.

This will free up pumps for other operations and minimise the energy costs associated

with the procedure. However, for this option, a separate air supply is required.

What do I need to get started?

Much of the equipment needed for the most basic aeration operations will probably already be in the winery. The key elements include:

- Air delivery device, which may be any of the following:
  - in-line sinter – requires pump and air supply
  - venturi device – requires pump only
  - drop-in sinter – requires air supply
  - fitted sinters – requires air supply

It is recommended to fit point-of-use filters and non-return valves to the air inlets of in-line spargers or venturi devices. Point of use filters prevent environmental contaminants entering the system and non-return valves prevent air-line contamination with liquid from the pump line when the aeration is stopped.

- Air supply – compressor or bottled gas. Ensure the air supply is food grade. See air quality section below for more details.
- Air delivery control – regulator and gas flow meter.
- A pump that is compatible with the in-line air delivery device (if that is the method chosen). It's important to consider the pressure drop across the device and whether the pump can sustain that pressure and flow rate.

For in-line air delivery devices it is advisable to attach them to the outlet side of the pump. This reduces the potential for vibration and premature failure of the pump seals and bearings.

When and how often do I need to aerate?

Aeration operations can be started after a 1-2 baumé drop, when the cap rises or when visible signs of fermentation are apparent.

Reductive aromas and modification of phenolic compounds will be most effectively managed with multiple daily aerations of about 30 minutes each. This can continue for several days until 60% of the initial sugar is used.

What airflow rate is required?

When using in-line or drop-in spargers, a reasonable starting airflow rate to work from is 0.5 L/min/kL of ferment volume.

Using a flow meter with a ball bearing indicator is a simple visual tool that let you know that the device is working and help to limit unnecessary and excessive use of air.

Flow meters help to reduce compressor run time and minimise system pressure fluctuations. If using bottled air, they also help limit the number of gas cylinders purchased. While they might seem like a moderately costly investment, that investment will pay off with time.

When using venturi injectors, airflow rate is dependent on the pump flow rate, the position of the device and the pressure drop across the device. As a result, precise control of the air introduced into the ferment may not be possible. It is possible to attach a simple gas flow meter to the device inlet to provide an idea of air the volume of air being drawn in.

How much oxygen do different methods introduce?

Table 1 provides information about the efficiency of different aeration methods. Note the effect of venturi placement near the outlet (high) is more effective at getting air into the ferment.

Table 1. Air saturation levels achievable from different aeration methods

Device	Placement†	DO (% air sat)
In-line sparger	Inlet	21.5%
'Cracking the fitting'	Inlet	37.3%
Venturi injector*	Outlet (low)	19.9%
Venturi injector*	Outlet (high)	42.2%

* Venturi injector size = 3 inch, † relative to the pump

Air quality

Air quality classes and testing methods for compressed air are defined by the ISO 8573 standard. The British Compressed Air Society recommends that air coming into direct contact with food should meet the following specifications where the classes are defined in ISO 8573.1.

Table 2. Recommended air quality for food grade gas

Class	Maximum number of particles per m^3 for particle sizes, d (µm)		
	0.1<d≤0.5	0.5<d≤1.0	1.0<d≤5.0
2	≤ 400,000	≤ 6,000	≤ 100
	Pressure dew-point (°C)		
2	≤ -40		
	Total oil concentration (liquid, aerosol, and vapour) (mg/m^3)		
1	≤ 0.01		

Compressed air can contain several contaminants. These can be introduced through the intake (water and particulates), through the mechanical compression process (lubricant) or can become part of the system (bacteria and rust).

Food grade compressed air cylinders are not typically available from bottled gas suppliers. Instrument grade air may come closest to matching the compositional standard presented in Table 2. Please consult suppliers for specific recommendations.

If using compressed air generated on-site, speak to your compressor supplier about ensuring the compressor air quality is fit for purpose. Evaluate the installation site of the compressor to ensure that environmental contaminants are not being incorporated into the air supply. Typically, inlet filters will help to reduce particulates being drawn in and condensers will reduce the humidity of the air on delivery.

Regardless of the source it would be prudent to consider point of use filters to minimise the risk of introducing contaminants into wine.

Reference and further reading

Day, M.P., Espinase Nandorfy, D., Bekker, M.Z., Bindon, K.A., Solomon, M., Smith, P.A., Schmidt, S.A. 2021. Aeration of *Vitis vinifera* Shiraz fermentation and its effect on wine chemical composition and sensory attributes. *Aust. J. Grape Wine Res.* 27(3): 360–377.

Understanding Food-Grade Compressed Air Standards: Air Quality Standards ISO 8573.1 & ISO12500. Available from: https://www.airbestpractices.com/system-assessments/air-treatmentn2/air-quality-standards-iso-85731-iso12500

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