

Fermentation's clean little secret



Kieran C. Hirlam¹, Tadro Abbott^{1,2}, Eric N. Wilkes¹

¹The Australian Wine Research Institute, PO Box 197, Glen Osmond (Adelaide) SA 5064, Australia
²Current address: CSIRO, Waite Campus, Urrbrae SA 5064, Australia

Corresponding author's email: kieran.hirlam@awri.com.au

Introduction

- Climate change has been called the largest risk to the global economy (World Economic Forum, 2016).
- There have been recent discussions within the wine industry about the importance of carbon dioxide emissions from fermentation and any resulting impact on climate change.
- Emissions from fermentations need to be understood within the context of wine's overall carbon footprint.

Carbon footprint of wine

- The estimated Australian wine industry carbon footprint in 2017 was 1.6 million tonnes of CO₂e compared to 22 million tonnes CO₂e for civil aviation in Australia.
- The average carbon footprint per litre of wine is 0.6 – 1.4kg CO₂e/L (Figure 1).
- Fermentation CO₂ is not included in carbon footprint calculations because it cycles within a few years from the atmosphere, through vine growth and then back to the atmosphere in an essentially CO₂-neutral manner. There is no net increase to atmospheric carbon levels over time, so these processes are not included in carbon footprint calculations.

Carbon footprint of wine
0.6 – 1.4kg CO₂e/L

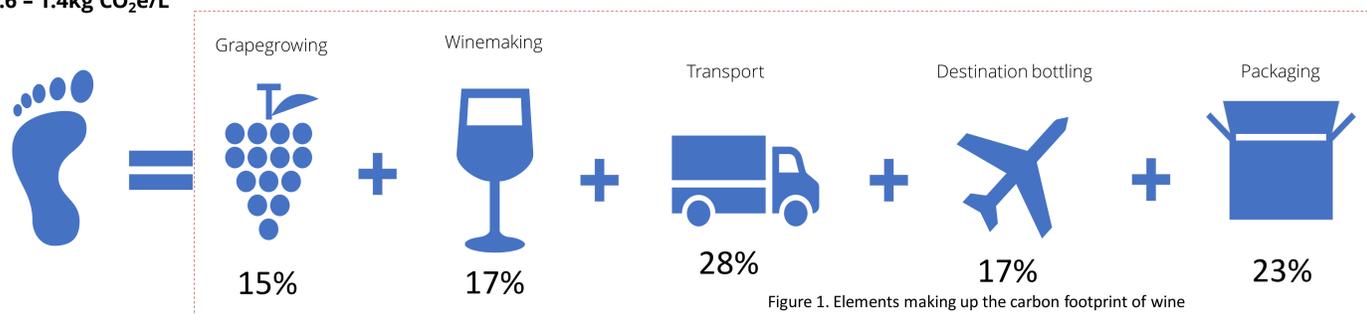
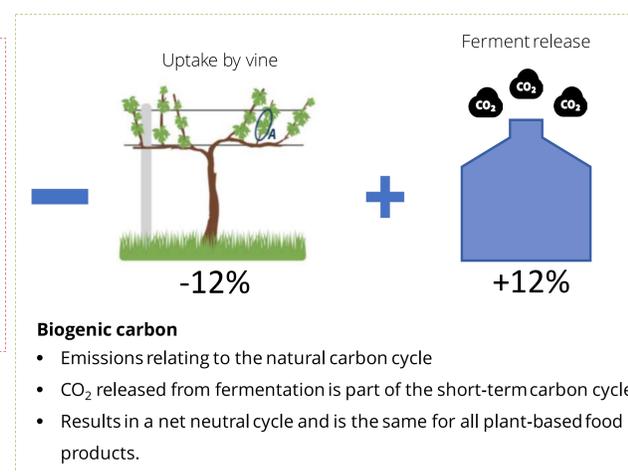


Figure 1. Elements making up the carbon footprint of wine



Why worry about ferment CO₂?



- The Paris Agreement is in place to reduce the amount of carbon input into the atmosphere with the goal of limiting global warming to 1.5°C.
- Proposed mechanisms for achieving this target include reducing reliance on fossil fuels and/or storing and capturing carbon emissions to prevent their release into the atmosphere.
- Fermentation exhaust is a much more concentrated source of CO₂ (up to 90% CO₂) than combustion exhaust from fossil fuels (~15%) and hence is easier to capture. This provides an opportunity to reduce wine industry emissions.

Options for capturing CO₂ during wine production

- The brewing industry has a long history of collecting CO₂ for reintroduction into processing for carbonation.
- Multiple companies have developed CO₂ capture and reuse systems for the wine industry such as Oresteo and ENOMET (Figure 2).
- Smith Haut Laffite in Bordeaux is capturing CO₂ and converting it into sodium bicarbonate as a by-product for other applications (Figure 3).
- Bodegas Torres in Spain has trialled conversion of ferment CO₂ into methane to use as a tractor fuel.
- Bodegas Torres has also investigated the conversion of captured CO₂ into solid carbonate for storage in the earth.
- A combination of some of the above options could prove the best way to maximise value from CO₂ capture.

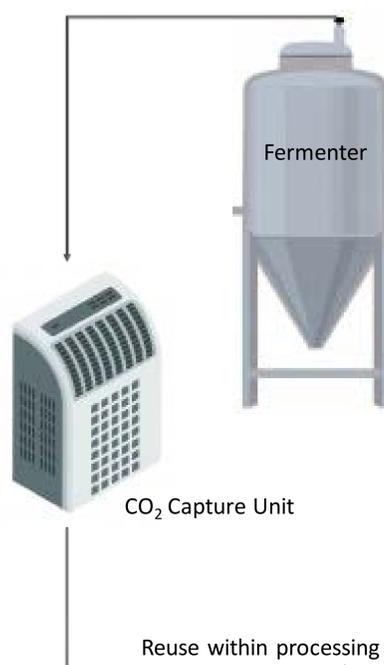


Figure 2. Example of CO₂ capture system used within the winemaking process.

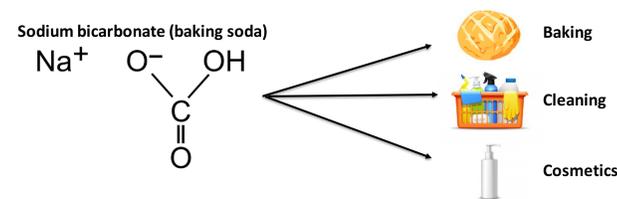


Figure 3. Sodium bicarbonate applications

Conclusion

- While fermentation CO₂ may only represent 10% of the available process carbon in wine production, capture of these emissions is a viable option for the wine industry that could offset other emissions.
- It is important that any focus on carbon capture does not limit efforts to reduce CO₂ emissions from other aspects of wine production that could provide more significant emission reductions.

