Factors affecting the formation and preservation of ‘struck flint’ aroma in wine

Marlize Bekker[1], Allie Kulcsar[1], Lisa Pisaniello[1], Flynn Watson[1], Tracey Siebert[1], John Gledhill[2]

[1] The Australian Wine Research Institute, PO Box 197, Glen Osmond (Adelaide) SA 5064, Australia,
[2]WIC Winemaking Services, PO Box 197, Glen Osmond (Adelaide) SA 5064, Australia

Corresponding author’s email: marlize.bekker@awri.com.au

Background

- Phenylmethanethiol (PMT), also known as benzylmercaptan, is a sulfur compound associated with ‘struck flint’ aroma in wine.
- ‘Struck flint’ aroma is sought after in premium Chardonnay and sparkling wine.
- However, there is little information available on winemaking techniques that can be used to dial this character up or down.

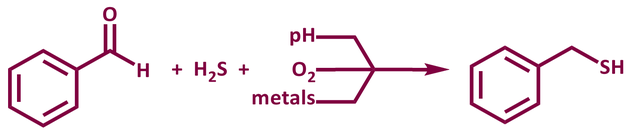
Research questions

- What winemaking techniques can be implemented to **increase and control PMT** concentrations?
- What can winemakers do to **preserve ‘struck flint’ aroma** in ageing wine?
- How do PMT concentrations **evolve** in ageing wine?

Experimental design

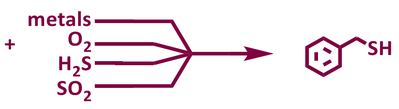
Formation

The effects of pH, oxygen, copper (0.5 mg/L), and iron (4 mg/L) on the formation of PMT from its precursors, benzaldehyde (5 µM) and hydrogen sulfide (H_2S, 5 µM), were evaluated over a 17-month period in model wine (Figure 1).



Preservation

Model systems were used to evaluate the effects of copper (0.5 mg/L), iron (4 mg/L), oxygen, and elevated residual concentrations of H_2S (10 and 40 µg/L) and sulfur dioxide (SO_2, 20 and 40 mg/L) on the preservation of PMT (Figure 2).



Evolution in Ageing Wine

The evolution of PMT in ageing wine was studied over the course of six months in ten Chardonnay wines (Figure 3).

Formation

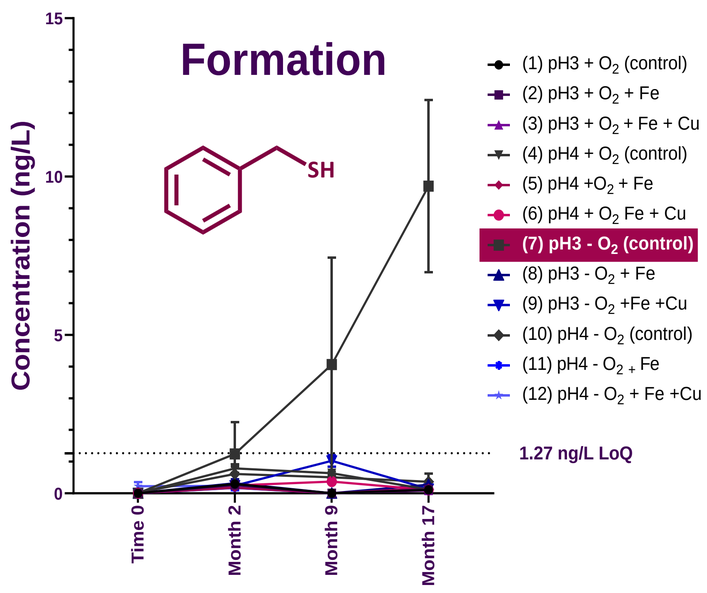


Figure 1. Evaluating factors that influence PMT formation from its precursor compounds, benzaldehyde and hydrogen sulfide

Preservation

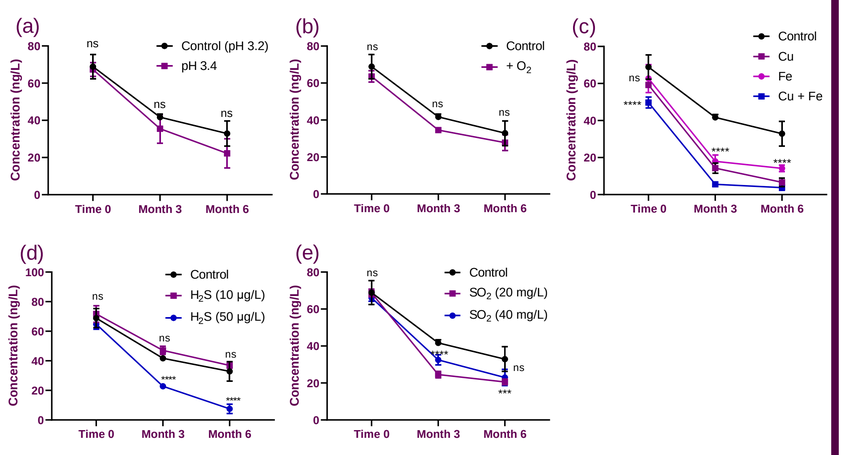


Figure 2. Evaluating factors that influence PMT preservation

Evolution

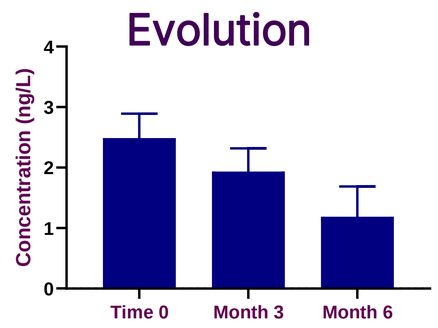


Figure 3. The average concentration of PMT measured in 10 wines over the course of six months

Results

Formation

- No PMT was produced in samples exposed to oxygen (Figure 1) → due to the oxidation of the precursor compound, H_2S.
- No PMT was produced in samples treated with Cu and Fe (Figure 1) → due to complexation of precursor compound, H_2S, with Cu and Fe (Figure 1).
- PMT was only produced in model wine (pH 3) protected from oxygen without the presence of metals (Figure 1).

Preservation

- PMT decreased in all samples over the course of six months (Figure 2).
- pH had no effect on PMT preservation.
- Exposure to oxygen resulted in a slight decrease in PMT concentrations (Figure 2b).
- Cu and Fe significantly decreased PMT concentrations, with the combination of Cu + Fe having the most detrimental effect on PMT preservation (Figure 2c).
- High concentrations of H_2S significantly decreased PMT over time (Figure 2d).
- High concentrations of SO_2 significantly decreased PMT over time (Figure 2e).

Evolution in Ageing Wine

- PMT decreased in all 10 wines after six months (Figure 3).

Take-home messages

- **Anaerobic conditions promoted** the formation of PMT from H_2S and benzaldehyde.
- **Metal ions inhibited** PMT formation and have detrimental effects on its preservation.
- PMT concentration **naturally decreased** in ageing wine.

Wine Australia

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