Technical notes

Effect of juice heating on the sensory profile of wine

Introduction

Wine haze is caused by grape proteins that persist during winemaking and can later unfold and aggregate during wine storage, particularly at elevated temperatures (Van Sluyter et al. 2015). Haze prevention therefore relies on removing these proteins from wine before packaging. Removal of protein is commonly achieved using bentonite, a clay that binds proteins and settles, producing protein-rich bentonite lees. Bentonite addition is effective in 'heat stabilising' wines, but comes with a substantial cost in terms of the wine lost in bentonite lees or downgraded when recovered from lees. Reducing bentonite requirements or finding an alternative to bentonite would therefore have benefits for wine producers.

One promising alternative to bentonite is a combined treatment where enzymes are added to juice and then the juice is heated to 75°C for 1 minute (Marangon et al. 2012). This technology can produce heat-stable wine although it relies on the availability of equipment for heating juice as well as a supplier of the aspergillopepsin enzymes. The process of heating juice is also a concern for winemakers as it is perceived by some as an unacceptable risk to wine sensory profiles.

To address these concerns, the impact of heating juice on wine sensory profiles was investigated. Batches of 2018 vintage Semillon and Sauvignon Blanc juice from the Riverland, SA, were heated at 75°C for periods of 1 and 2 minutes using a commercial-scale flash pasteurisation unit developed by VA filtration. The flow rates for the 1- and 2-minute heat treatments were approximately 1,900 L/h and 900 L/h respectively. Juice was heated from 4°C and maintained at 75°C for the required time for each treatment. Juice exiting the unit was 12°C, indicating an overall increase in temperature of 8°C between input and output.

Table 1. Malic acid concentrations for Semillon and Sauvignon Blanc wines (g/L) produced from heat-treated or unheated juice. Results are shown as the average of triplicate ferments ± one standard deviation.

Sample	Semillon	Sauvignon Blanc
Control	<0.05 ± 0.00	0.41 ± 0.14
1 minute heating	1.10 ± 0.16	1.31 ± 0.12
2 minutes heating	0.98 ± 0.20	1.39 ±0.01

Heated and unheated batches of juice (200 L each) were stored at 0°C before being fermented and cold stabilised. Control wines (made from juice with no heat treatment) were then split into two batches, with half being fined with bentonite and half left unfined.

Effects of juice heating on fermentation and protein concentration

The most notable effect of heating juice in this trial was that it prevented spontaneous malolactic fermentation (MLF). Unheated control ferments went through primary and malolactic fermentation simultaneously, whereas the heat-treated juice ferments did not (Table 1). This may be because the heat treatment degraded some of the nutrients required for MLF or killed any lactic acid bacteria present. However, co-fermentation substantially increased the average fermentation time for the control ferments compared to that of the heat-treated ferments (56 and 44 days, respectively for Semillon, and 120 and 70 days respectively for Sauvignon Blanc).

Heating juice for 1 minute also substantially reduced the juice protein concentration by 58% and 63% for Semillon and Sauvignon Blanc respectively (Figures 1a and b). Heating was most effective in removing chitinases, which are less stable than thaumatin-like proteins and therefore more likely to form a haze (Van Sluyter et al. 2015). Heating juice for an additional minute did not substantially change the protein concentration. The reduction in protein concentration in the heat-treated juice is similar to that reported previously (Marangon 2012) and suggests that heat-treating juice may also reduce bentonite requirements (Marangon 2012).

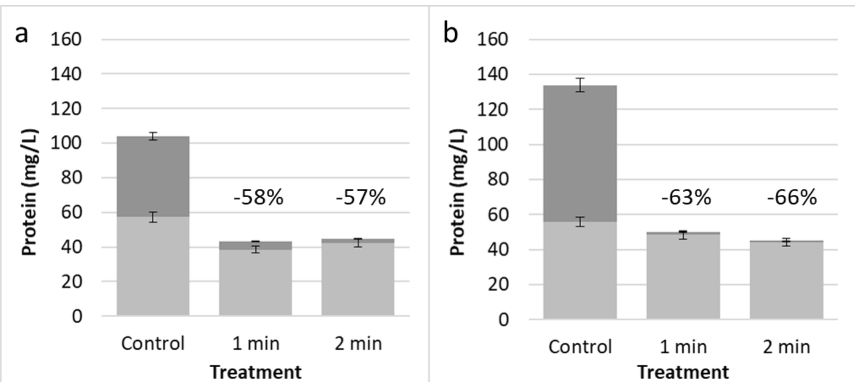

Figure 1. Juice concentrations of haze-forming proteins including thaumatin-like proteins (light grey) and chitinases (dark grey) in unheated control juice and juice heated for 1 and 2 minutes at 75°C for a) Semillon and b) Sauvignon Blanc, including the per cent reduction in haze-forming protein concentration compared to the unheated control.

Wines produced from heat-treated juice contained similar protein concentrations to that of the juice prior to ferment, as expected; however, the wines produced from unheated juice contained substantially less protein than the juice (data not shown).

Does heating juice affect wine colour?

Browning is an important concern for makers of white wines and heating juice is perceived to have the potential to change wine colour. Colour parameters were measured using the CIELab method, with the bentonite-fined control wines and wines made from heat-treated juice compared to the unfined control wines (Figure 2). There were no significant differences between the treated and control wines. This suggests that there was no oxygen uptake during heating and therefore no oxygen-induced browning.

Does heating juice change wine flavour?

A critical concern when heat-treating grape juice is any potential effect on wine flavour and aroma. Triangle tests were performed using a panel of approximately 30 wine consumers to identify if there were any differences between wines made from the juice that had been heated for 1 minute and the unheated control wines (both unfined and bentonite fined). Sensory analyses were conducted on the wines six months after bottling.

No significant differences were found ($p < 0.05$) between wines made from heated juice and either of the control wines (unfined and bentonite fined) for both Semillon and Sauvignon Blanc (Table 2). This suggested that any changes in wine composition with heating or with MLF were not sufficiently substantial to significantly change the sensory profile. Heating juice to 75°C for only a short amount of time and without the presence of oxygen is unlikely to remove volatile aroma compounds and many aroma compounds are also only produced by yeast during fermentation. These results support previous trials that also demonstrated no

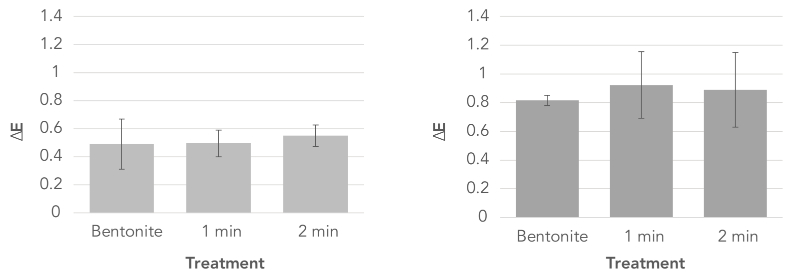

Figure 2. Differences in wine colour parameters (ΔE) of bentonite-fined control wines and wines produced from heated juice (1 and 2 minutes at 75°C) as compared to the colour parameters of unheated and unfined control wines for a) Semillon and b) Sauvignon Blanc wines. Results are shown as the average of three replicate ferments ± one standard deviation.

Table 2. Results of the triangle tests used to assess any sensory differences between wine produced from juice heated for 1 minute at 75°C and either of the control wines made from unheated juice (unfined or bentonite-fined).

Test	Comparison	Number of responses	Correct answers	Significance
1	Unfined control wine (made from unheated juice) vs wine made from juice heated for 1 minute (Sauvignon Blanc)	30	10	ns
2	Bentonite-fined control wine (made from unheated juice) vs wine made from juice heated for 1 minute (Sauvignon Blanc)	30	10	ns
3	Unfined control wine (made from unheated juice) vs wine made from juice heated for 1 minute (Semillon)	31	10	ns
4	Bentonite-fined control wine (made from unheated juice) vs wine made from juice heated for 1 minute (Semillon)	31	14	ns

ns = not significant at $p<0.05$

significant change in wine sensory profiles caused by short-term heating of juice (Marangon 2012).

Conclusion

In this trial, heating Semillon and Sauvignon Blanc juice to 75°C for 1 minute did not induce significant changes to the sensory profiles or colour of the wines made from the heated juice, and did substantially reduce juice protein. These results are consistent with previous studies and suggest that winemakers who wish to trial heat treatment of juice should not be concerned about sensory impacts on wine.

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References

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Jacqui McRae, Senior Research Scientist (now at the University of Adelaide's ARC Research Hub for Graphene Enabled Industry Transformation)
Peter Godden, Manager – Industry Engagement and Application, *peter.godden@awri.com.au*
Elia Romanini, Visiting PhD student, Università Cattolica del Sacro Cuore, Italy