Preventing Potassium Tartrate crystallisation

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Introduction

The performance of Claristar™ was tested for the cold stabilisation of wines. Claristar, a product from DFS (DSM Food Specialties, The Netherlands), prevents the formation of potassium bi-tartrate (KHT) crystals under adverse conditions. Claristar is a patented product derived from *Saccharomyces cerevisiae* yeast and manufactured under strict conditions, resulting in highly functional and soluble mannoproteins that prevent the nucleation step in the KHT crystallisation process. Claristar was successfully introduced in Europe two years ago, and shows good performance to prevent KHT crystal formation. It is a FSANZ-approved wine additive.

The expected benefits of using Claristar over traditional cold stabilisation methods are:

- reduced time required to cold-stabilise wines
- reduced energy demand through avoiding an energy intensive cold stability method
- reduced water use
- less product losses
- a sustained stability
- Claristar is a natural 100% yeast-derived product and is easy to use in a liquid form.

Trials were conducted by Provisor to determine:

- Trial 1: To assess the dose response of Claristar on the stabilisation of KHT in 11 unstable white wines sourced from a number of wine regions in Australia and one region in New Zealand; and
- Trial 2: To assess the dose response of Claristar on the stabilisation of KHT in five of the Trial 1 wines adjusted to 12g/L residual sugar and one wine naturally containing 22g/L.

Methods

Table 1 lists which wines were included in Trials 1 and 2.

Table 1. Wines for Trials 1 and 2.

Wine code	Trial 1	Trial 2	Region and variety
1	✓	✓	Riverland Chardonnay (SA)
2	✓	✓	Riverland Sauvignon Blanc (SA)
3	✓		Riverina Chardonnay (NSW)
4	✓		Riverina Chardonnay (NSW)
5	✓		Wrattonbully Sauvignon Blanc (SA)
6	✓		Sunraysia Chardonnay (NSW/Vic)
7	✓		Tamar Valley Sauvignon Blanc (Tas)
8	✓		Marlborough Sauvignon Blanc (NZ)
9	✓	✓	King Valley Chardonnay (Vic)
10	✓	✓	King Valley Sauvignon Blanc (Vic)
11	✓	✓	Eden Valley/Adelaide Hills Chardonnay (SA)
12		✓	Riverina, Sweet Traminer (Res Sugar 22g/L) (NSW)

All wines were analysed for alcohol, pH, TA, VA, malic acid, glucose/fructose, polyphenol index, tartaric acid, potassium, and calcium. The concentration product and relative supersaturation were calculated based on the wines' composition, and compared against the stability criteria developed by the AWRI (Leske *et al*. 1995) and Rhein & Neradt (1979). In addition, the stability was checked through the determination of the saturation temperature and against stability criteria from the Easy Krista test from Erbsloh.

Preparation for the trials included:

- Bentonite fining for protein-unstable wines
- SO_2 analysis and Free SO_2 adjustment to 25-30ppm
- additions of juice concentrate for Trial 2 wines to adjust sugar content to 12g/L
- filtration to 0.65µm to ensure turbidity was less than 2NTU
- Claristar was added to 100mL of wine in a flagon at concentrations of 75, 100 and 125mL/hL. The recommended dosage rate is 100mL/hL (= 1L/kL)
- the wines were placed in a temperature-controlled refrigerator at -4°C for a period of days
- the wines were visually monitored at Day 1, Day 3, Day 6 and Day 10 (if no change after six days) for any turbidity or crystal formation in the wine.

Results

The compositional variation of the untreated wines in Trials 1 and 2 is given in Table 2. The stability status of the untreated wines is presented in Table 3. The highest turbidity of the wines after filtration was 0.88NTU in Wine 5.

Table 2. Compositional variation of untreated wines.

Min.	Max.	Avg.	std. dev.	
11.3	13.7	12.4	0.8	% Alcohol
3.2	3.5	3.3	0.1	pH
4.9	7.4	6.4	0.7	TA (g/L)
0.0	0.5	0.3	0.2	VA (g/L)
0.6	3.2	2.0	0.8	Malic acid (g/L)
0.4	23.5	3.3	6.5	Glucose+Fructose (g/L)
3.43	4.09	3.75	0.19	Absorbance at 280nm
0.05	0.12	0.08	0.03	Absorbance at 420nm
4.70	7.20	6.02	0.87	Polyphenol Index
1.7	3.4	2.5	0.4	Tartaric Acid (g/L)
567.0	826	695.7	97.4	Potassium (mg/L)
47.0	103.0	74.6	14.6	Calcium (mg/L)

Table 3. Stability of all wines in accordance with criteria by the AWRI and Rhein & Neradt.

Wine No.	Concentration product (C.P.)	AWRI stability definition[1]	R^2 (%)	Rhein and Neradt stability definition[3]	T-sat[4] (°C)	Erbsloh – Easy Krista[5]
1	$1.40x10^{-4}$	unstable	1.32	unstable	12.6	unstable
2	$2.19x10^{-4}$	unstable	1.67	unstable	17.6	unstable
3	$2.19x10^{-4}$	unstable	1.99	unstable	18.5	unstable
4	$2.39x10^{-4}$	unstable	2.09	unstable	19.2	unstable
5	$2.20x10^{-4}$	unstable	2.01	unstable	18.2	unstable
6	$1.55x10^{-4}$	unstable	1.30	unstable	15.7	unstable
7	$1.61x10^{-4}$	unstable	1.33	unstable	14.2	unstable
8	$2.09x10^{-4}$	unstable	1.91	unstable	11.4	stable
9	$1.73x10^{-4}$	unstable	1.79	unstable	18.4	unstable
10	$1.44x10^{-4}$	unstable	1.21	unstable	13.7	unstable
11	$1.30x10^{-4}$	unstable	1.43	unstable	14.8	unstable
12	$1.34x10^{-4}$	unstable	1.19	unstable	14.4	unstable

[1] C.P. value for stable wines is < 8.0x10-5
[2] R = Relative super-saturation
[3] If $R < 0.2$ then wine is stable; if $R = 0.2 \leq R \leq 0.6$ then crystallization is unlikely to occur; if $0.6 < R < 3.0$ crystallization is normal and rapid; if $R \geq 3.0$ crystallisation is very rapid
[4] T-sat = Saturation temperature
[5] If T-sat is higher than 12°C then wine is unstable.

There was good correlation amongst the three stability criteria with the exception of Wine 8 which was stable according to the Easy Krista Test but unstable according to the other two criteria. All other wines were unstable against all applied criteria.

Table 4 lists the concentrations of Claristar that were required to keep Trial 1 wines stable over a 10-day period at -4ºC. In Trial 1, two of the 11 tested wines (Wines 1 and 6) remained physically stable without Claristar addition, despite being considered unstable against the applied stability criteria. Seven wines were stabilised with the recommended dosage of 100mL/hL. Only Wine 8 did not remain stable for 10 days at the highest dosage rate of 125mL/hL, despite being the only wine considered stable against the criteria from the Erbsloh test. Crystals only formed after seven days at the higher concentration; hence Claristar would still be considered effective under the OIV criteria.

Table 5 lists the concentrations of Claristar that were required to keep Trial 2 wines stable over a 10-day period at -4ºC. In Trial 2, three of the six wines remained physically stable without Claristar addition. The other three wines were stabilised with 100mL/hL Claristar. Wine 10 was stable in Trial 2 without Claristar, but not in Trial 1. The difference may have been due to the addition of juice concentrate.

Table 4. Stabilisation results with Claristar to prevent KHT crystallisation for 10 days at -4°C in Trial 1 wines.

Wine No.	Stability without Claristar	Stability with 100ml/hL
1	Yes	-
2	No	Yes
3	No	Yes
4	No	Yes
5	No	Yes
6	Yes	-
7	No	Yes
8	No	No[1]
9	No	Yes
10	No	Yes
11	No	Yes

[1]Wine 8 was stable for 6 days at a dosage rate of 125ml/hL, after which crystal formation started.

Conclusions

Claristar has been successful in preventing the formation of KHT crystals with a wide range of white wines under adverse conditions of -4°C for 10 days. This test is much more rigorous than the OIV method of six days at -4°C. All of the untreated wines were considered unstable based on the three criteria except Wine 8 (which was stable based on the Erbsloh test, but unstable against the other criteria). Three of the Trial 2 wines were stable without Claristar addition despite being considered unstable against the applied stability criteria. In general, a recommended dosage rate of 100mL/hL was effective in preventing KHT crystallisation. Only one wine required a higher dosage of 125mL/hL to prevent crystal formation up to seven days.

Further work

DFS is further exploring the potential of using Claristar in Calcium Tartrate (CaT) unstable wines.

Table 5. Stabilisation results with Claristar to prevent KHT crystallisation for 10 days at -4°C in Trial 2 wines.

Wine No.	Stability without Claristar	Stability with 100mL/hL
1	Yes	-
2	No	Yes
9	No	Yes
10	Yes	-
11	No	Yes
12	Yes	-

Disclosure

Wine Technical Consultancy Provisor was engaged by DFS to conduct the testing in 2008. Full details of this study are available from Judi Buckingham of DSM Food Specialties Australia - Free Call 1800 029 707.

References

Leske P.A., Bruer N.G.C., and Coulter A.D. (1995). Potassium tartrate – how stable is stable? In: "Proceedings of the 9th Australian Wine Industry Technical Conference", 39–49.

Rhein O., and Neradt, F. (1979). Tartrate stabilisation by the contact process. *American Journal of Viticulture and Enology* 30, 265 – 271.

Teralba's new hygiene mixer

Mixquip, a division of Teralba Industries Fluid Process equipment has released a new Mixquip Top Entry Agitator that incorporates IP66 drive assembly and all stainless steel construction to meet the increased demand of quality produced food beverages.

This new Australian-made top entry agitator provides the ultimate in high efficiency, hygienic mixing and blending of all liquids, colour-additives, flavour, yeasts and powder additions.

Used for mixing syrups, beverages and sugar solutions this agitator is constructed of all stainless steel alloy and polished for ultimate hygiene and enhanced cleaning properties.

Brent Ovenden at teralba Industries in Campbelltown said that with full washdown capability the new sanitary design top entry agitator lends itself to all blending and mixing applications across a broad spectrum of industries: including food, dairy, pharmaceutical, meat, wine and poultry.

"This new sanitary design retains the features that have made Mixquip the preferred band for agitation mixing equipment throughout Australia:

- over 30 years experience in the design and construct of agitators and mixers
- proven modular designs
- continuous innovation in impellor design lending to ultra high efficiency while achieving
- sanitary and durable configuration
- precision balance componentry including shafts and impellors," he said.

For further information contact Brent Ovenden at Teralba Industries (02) 4626 5000 email mixquip@teralba.com or visit www.teralba.com