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Procork
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Commercial Closure trial – 12 Month Summary Report Performance Testing of Procork's Membrane Cork closure

Dear Mr Gregor Christie,

PROTOCOL

The protocol has not changed since the commencement of the Commercial Closure Trial and is not described here. However, brief descriptions of the techniques relevant to this phase of the trial are provided in the experimental section. Cartons containing 12 previously randomised bottles were selected from the cartons stored inverted in the cellar on pallets with approximately 64 cartons to the pallet.

The samples were tested for free sulfur dioxide, total sulfur dioxide and the optical density at 420 nm. Further samples were used for sensory evaluation. The results and number of replicates for each test are identified in the tables of results in Tables 2 for chemical data and Table 3 for sensory data

EXPERIMENTAL

Methods of chemical analysis

Optical density was determined by measurement of the absorbance at 420nm on a Varian UV/visible spectrophotometer. Free and total sulfur dioxide were measured using the aspiration method. Most of these methods are approved methods covered by the laboratories NATA accreditation. All analyses were performed by trained staff and were performed in conjunction with quality assurance measures including standards, blanks, duplicates and control samples where appropriate. The quality control measures were required to meet established criteria before acceptance of the analytical data.

Method of sensory evaluation

A panel of 10 judges was recruited, comprising AWRI staff with extensive experience in wine sensory evaluation, of whom all but three had participated on the sensory panel for the 6 month assessment of the wine (Godden et al 2001, Godden et al 2002). An initial discussion session was held, with the tasters assessing six of the wines from the current study. These wines were selected based on a preliminary evaluation to identify those samples displaying the largest sensory differences, and included the two of reference closures. The tasters assessed the wines in silence, followed by a discussion regarding the sample's characteristics, to decide upon the attributes that would be rated in the subsequent formal sessions. A list of the terms that was agreed upon by the panellists is given in Table 1. As at 6 months, not all of these attributes were thought to be required for the wines at this time point, but considering the experience of the research closure trial, it was agreed that the panellists should have the opportunity to rate a number of attributes that would be likely to be important to the wines at a later testing period (notably at this testing time no wine was considered to display any degree of oxidised flavour during the attribute selection session). For three of the attributes a reference standard was provided, however for most a verbal definition was considered appropriate.

Table 1. Sensory attributes scored.

Attribute	Definition or composition of reference standard^a
Overall Fruit	definition: citrus, pineapple
Honey (aroma only)	definition: honey
Toasty (aroma only)	definition: aged Semillon aroma, complex buttered, toasty
Oxidised (aroma only)	definition: bruised apple, aldehyde
Glue/Plastic/Solvent	1 drop plastic bonding glue dissolved in acetone (0.1% v/v)
TCA	2,4,6-trichloroanisole (TCA) 5ng/L
Cork wood	definition: woody, corks soaked in wine
Struck Flint/rubber (aroma only)	definition: rubber and freshly struck match/flint
H ₂ S/Cabbagey (aroma only)	definition: rotten egg, cabbage, sewerage
VA	definition: volatile, acetic acid
Reduced (palate only)	definition: rubbery, cabbagey
Overall Fruit Persistence (palate only)	duration of perceived fruit flavour

^ain 100mL neutral white wine

Following the discussion session, one practice rating sessions were carried out in isolated tasting booths.

For the formal session, samples were assessed in blind tasting conditions using standardised procedures. Fourteen closures were assessed at a session, being one example of each closure in the study. Four bottles of each closure type were assessed over four sessions. The samples were presented to tasters in coded, covered XL5 (ISO standard) glasses, in a random order with a constant volume of wine in each glass (25mL). The tasters were instructed to assess each wine for aroma and then palate. The tests were carried out in the Institute's purpose built sensory facility in isolated, temperature controlled, ventilated tasting booths under sodium lighting to mask any possible colour differences, with temperature control between 22-24°C. Data was acquired using Fizz 2.00e software (Biosystemes, Couternon, France).

The panellists scored each attribute on a scale of 0-9; where 1 corresponds to just detectable, 5 to a moderate intensity and 9 to a very strong intensity. Tasters were also given the opportunity to rate on any other attributes evident in any sample.

Data analysis was carried out using Genstat 6 (VSN International, UK). Analysis of variance was carried out testing for the effect of closure and bottle replicate nested within closure type, using a mixed model treating judges as a random effect.

RESULTS

Chemical analysis:

The levels of free and total sulfur dioxide in wine are considered to be a critical parameters with respect to the stability of the wine and provides protection against oxidation and therefore accelerated development of the wine. As was evident from the AWRI research closure trial (Godden, 2001) losses of free and total sulfur dioxide occur with time irrespective of the various closure types under trial. The losses over time in that trial were found to be less with the ROTE type closure than corks, technical corks and synthetic closures.

Similar losses are evident in this trial when comparing the initial data with the 12 month data for all closures in the trial. At the 12 month testing point the differences between the ROTE closure, the reference 2 and reference 3 closures and Procork's Membrane Cork with respect to the loss of both free and total sulfur dioxide is relatively small. It appears too early in the trial to draw any valid conclusions with respect to relative performance. Results over the longer period of the trial may provide more evidence of differences in performance.

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Procork 12 month summary report
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Sensory evaluation:

From the analysis of variance of the sensory data, it was found that there were significant differences among the 14 closures for the aroma attributes: estery, citrus, overall fruit, glue/plastic, struck flint/rubber, H₂S/cabbagey and TCA; and for the palate attributes: overall fruit, fruit flavour persistence and TCA. The other attributes rated did not differ significantly among the closures.

It should be noted that although the methods used for the sensory assessment at this time point were closely similar to those used at the previous six months assessment, the panels used differed slightly in make up, which means that comparing mean values across the two time periods could be potentially misleading. Comparisons among closures at a time point are more meaningful.

There were no significant differences between the reference 2 and 3 closures and Procork's Membrane Cork. However, the H₂S / cabbagey and flint/rubber aroma was evident at low level in the screw capped bottle. The monitoring of these parameters at 18 and 24 months should provide evidence of differences in relative closure performance between the other samples. For queries about the sensory evaluation please contact Ms Kate Lattey or Dr. Leigh Francis

References:

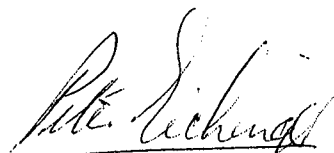
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Peter Eichinger
Manager-Analytical Service
30 October 2003

Attachments:

Table 2. Summary Comparison of Initial and Twelve Month Chemical and Physical Testing on Reference Closure.

Table 3: 12 month sensory testing of Procork' Membrane Closure and Reference Closures

Appendix 1 Terms and Conditions

The Australian Wine Research Institute Analytical Service Procork 12 month summary report ABN 83 007 558 296	Waite Road Urrbrae SA 5064 PO Box 197, Glen Osmond SA 5064 Telephone 08 8303 6600 Facsimile 08 8303 6601 Email: analyticalservice@awri.com.au
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Table 2. Summary Comparison of Initial and Twelve Month Chemical and Physical Testing of the Reference Closure and Procork's Membrane Cork.

		Initial	12 month	Initial	12 month	Initial	12 month
Auscap-ROTE		Free SO ₂ mg/L	Free SO ₂ mg/L	Total SO ₂ mg/L	Total SO ₂ mg/L	OD420 a.u.	OD420 a.u.
	Mean	38	25.0	111	98.0	0.047	0.056
	Std deviation	2	1.7	1	2.0	0.002	0.002
	n	12	12	12	12	12	12
Reference 2		Free SO ₂ mg/L	Free SO ₂ mg/L	Total SO ₂ mg/L	Total SO ₂ mg/L	OD420 a.u.	OD420 a.u.
	Mean	39	25.8	113	99.3	0.052	0.064
	Std deviation	2	1.0	2	2.2	0.004	0.003
	n	12	12	12	12	12	12
Reference 3		Free SO ₂ mg/L	Free SO ₂ mg/L	Total SO ₂ mg/L	Total SO ₂ mg/L	OD420 a.u.	OD420 a.u.
	Mean	39	23.1	112	93.9	0.052	0.063
	Std deviation	2	2.0	2	3.8	0.003	0.003
	n	12	12	12	12	12	12
Procork's Membrane Cork		Free SO ₂ mg/L	Free SO ₂ mg/L	Total SO ₂ mg/L	Total SO ₂ mg/L	OD420 a.u.	OD420 a.u.
	Mean	39	28	113	103	0.051	0.060
	Std deviation	2	1	3	2	0.003	0.002
	n	12	12	11	12	12	12

Table 3: 12 month sensory testing of Procork's Membrane Cork and Reference Closures

Sensory data for each of the four replicate bottles assessed (mean scores of 10 tasters), and mean data for each closure type, averaged across replicates.

Closure	Replicate	estery (aroma)	citrus (aroma)	fruit aroma (aroma)	glue/plastic (aroma)	TCA (aroma)	flint/rubber (aroma)	H ₂ S / Cabbagey (aroma)	overall fruit flavour (palate)	fruit flavour persistence (palate)	TCA (palate)
AUSCAP-L	1	3.5	4.1	4.5	0.6	0.0	1.5	0.4	4.7	4.8	0.0
AUSCAP-L	2	3.3	4.0	4.8	0.9	0.0	1.3	0.6	4.6	4.5	0.0
AUSCAP-L	3	3.6	4.6	4.9	1.0	0.0	1.5	0.2	4.6	4.7	0.0
AUSCAP-L	4	3.9	4.7	5.4	0.3	0.0	1.2	0.7	4.9	4.9	0.0
	<i>Mean</i>	3.6	4.3	4.9	0.7	0.0	1.4	0.5	4.7	4.7	0.0
	<i>Std dev.</i>	0.2	0.3	0.4	0.3	0.0	0.2	0.2	0.1	0.2	0.0
REF 2	1	4.0	4.1	4.5	0.1	0.0	0.5	0.1	4.7	4.5	0.0
REF 2	2	3.4	4.2	4.8	0.6	0.0	0.2	0.0	4.9	5.0	0.0
REF 2	3	3.2	3.7	4.7	0.0	0.2	0.4	0.1	4.7	4.5	0.2
REF 2	4	4.0	4.6	5.1	0.2	0.0	0.5	0.2	4.7	4.3	0.0
	<i>Mean</i>	3.6	4.2	4.8	0.2	0.0	0.4	0.1	4.7	4.6	0.0
	<i>Std dev.</i>	0.4	0.4	0.2	0.3	0.1	0.2	0.1	0.1	0.3	0.1
REF 3	1	3.5	4.0	4.8	0.4	0.0	0.7	0.0	3.8	4.0	0.5
REF 3	2	3.5	4.4	4.8	0.8	0.0	0.1	0.2	4.5	4.3	0.0
REF 3	3	3.9	4.0	4.8	0.0	0.2	0.3	0.3	4.6	4.5	0.1
REF 3	4	2.9	4.4	4.8	0.3	0.0	0.0	0.0	4.7	4.6	0.0
	<i>Mean</i>	3.4	4.2	4.8	0.4	0.0	0.3	0.1	4.4	4.3	0.1
	<i>Std dev.</i>	0.4	0.3	0.0	0.3	0.1	0.3	0.1	0.4	0.2	0.2
PROCORK	1	3.5	4.2	4.6	0.9	0.0	0.8	0.4	4.4	4.5	0.0
PROCORK	2	4.1	4.6	5.1	0.4	0.0	0.7	0.0	4.7	4.6	0.0
PROCORK	3	3.3	4.1	4.6	0.6	0.0	1.4	0.0	4.6	4.0	0.0
PROCORK	4	3.9	4.4	4.9	0.6	0.1	0.6	0.0	5.0	4.9	0.0
	<i>Mean</i>	3.7	4.3	4.8	0.6	0.0	0.9	0.1	4.7	4.5	0.0
	<i>Std dev.</i>	0.3	0.2	0.2	0.2	0.0	0.3	0.1	0.2	0.3	0.0

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APPENDIX 1

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1. The receipt of samples for analysis by the AWRI constitutes an acceptance of the following terms and conditions.
2. When providing samples to the AWRI, the client/customer must give written notice of all known safety or health hazards and special procedures relevant to the handling, testing, storage, transport and disposal of samples. The AWRI reserves the right to refuse to conduct any test where such testing may pose a health or safety hazard.
3. Unless the AWRI has agreed in writing, the client/customer is responsible for the collection of samples, and for arranging the delivery of samples to the premises of the AWRI.
4. The client/customer is responsible for ensuring that any samples supplied for testing are representative of the product to be analysed, and for retaining any duplicate or control samples.
5. The client/customer understands that the AWRI will test the samples provided by the client/customer as received, and that the samples provided may not be representative of the total quantity of wine or other material being tested, and that therefore any test results provided by the AWRI will only be representative of the sample provided.
6. The client/customer acknowledges that during the conduct of any testing, the samples or parts thereof may be altered, damaged, lost or destroyed. The AWRI, its proprietor, its officers, employees or agents, shall not be liable to the client/customer or any third party for any samples that are altered, damaged, lost or destroyed during the conduct of the services.
7. Unless the AWRI agrees in writing prior to the commencement of any testing, the AWRI shall not be obliged to return samples to the client/customer and may at its discretion store, analyse, destroy or dispose of any samples in any manner it sees fit.
8. The client/customer hereby releases the AWRI, its proprietor, its officers, employees or agents from any present or future claim, demand, action or judgement in relation to matters the subject of, or arising out of this agreement which may lie against the AWRI, its proprietor, its officers, employees or agents, other than in respect of acts performed negligently by the AWRI, its proprietor, its officers, employees or agents, and that relate to this agreement.
9. The client/customer will indemnify and will keep indemnified the AWRI, its proprietor, its officers, employees or agents, against any present or future claim, demand, action, judgement, expense or liability, made or recovered from or against the AWRI, its proprietor, its officers, employees or agents, arising directly or indirectly in connection with this agreement, other than where such arises as a direct result of the negligence of the AWRI, its proprietor, its officers, employees or agents
10. When testing relates to commercial products or services, any opinions expressed by the AWRI, its proprietor, its officers, employees or agents, in no way infers endorsement or otherwise of those products or services. Further, such opinions, whether supplied in writing or otherwise, shall not be used by the client/customer to advertise or promote those products or services.
11. When a written report on the findings of analysis is issued, the report becomes the property of the client/customer. However, such reports are issued on the understanding that they shall not be reproduced, except in full.
12. Any services provided under this agreement will be treated in strict confidence by the AWRI, and the AWRI, its proprietor, its officers, employees or agents shall not disclose to any third party the existence of any samples supplied by the client/customer under this agreement, or the existence of, or any information pertaining to any testing, results or reports, whether supplied in writing or otherwise, unless written authorisation to do so is supplied by the client/customer.
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