



The burning questions on smoke taint

WITH THE BUSHFIRE season looming, we are often asked questions about smoke damage to grapes and, ultimately, wine.

How are grapes and vines affected by bushfire smoke?

Numerous volatile phenols are present in bushfire smoke and can be absorbed by the grape berry and vine leaves during a smoke event. The volatile phenols undergo biotransformation within the plant, whereby they bind to various sugar molecules to form phenolic glycosides. This results in each volatile phenol forming up to seven non-volatile precursor compounds. These smoke taint precursor compounds can be hydrolysed during fermentation (and also over time), such that the volatile phenol portion is released. If enough volatile phenols are released, the result might be a smoke-tainted wine.

What compounds make up smoke taint?

The compounds guaiacol, methylguaiacol, ortho-, meta- and para-cresol (o-, m- and p-cresol), syringol and methylsyringol have been found to be particularly important to the 'smoky' sensory properties of smoke-affected wines, and have sensory thresholds as shown in Table 1.

Do the non-volatile compounds affect the taste?

When it comes to the sensory effects of smoke taint, the volatile phenols appear

Table 1. Sensory thresholds (in red wine) of some compounds responsible for 'smoky' sensory properties.

Volatile phenol compound	Sensory threshold
Guaiacol	23 µg/L
o-Cresol	62 µg/L
m-Cresol	20 µg/L
p-Cresol	64 µg/L

not to be the whole story. While the presence of the non-volatile phenolic precursor compounds should not affect the aroma of a wine, an experiment conducted at the AWRI showed the presence of guaiacol and m-cresol precursors (glucosides) caused significant smoky/ashy flavour when they were added to model wine. It is possible that other volatile phenol precursors might also affect the taste of wine.

What smoke taint analyses are available?

Given that the volatile phenol compounds guaiacol, methylguaiacol, o-, m- and p-cresol, syringol and methylsyringol have been identified in smoke and are indicative of smoke exposure in grapes and wine, these compounds are now measured by the AWRI's Commercial Service together in the one analysis. The results of this analysis help to give grapegrowers and winemakers an improved (compared with guaiacol and methylguaiacol only) understanding of the smoke effect at the time of fruit or wine analysis.

A method for the analysis of six

important volatile phenol precursors (phenolic glycosides) has also been developed by the AWRI and can be utilised to gain more information if necessary.

What do the results mean?

The results of the volatile phenol analysis, combined with a knowledge of typical 'background' levels and sensory thresholds of relevant compounds, can help winemakers conduct a risk-assessment of the potential for producing a smoke-tainted wine.

Analyses conducted at the AWRI on non-smoke-affected grapes and wines over the past two years have greatly improved our ability to determine whether grapes have been exposed to smoke. However, while low and high levels of volatile phenols and their precursors are relatively easy to interpret (i.e., not smoke-affected and smoke-affected, respectively), it is more difficult to interpret the effect 'intermediate' levels of these compounds will have on the sensory profile of a finished wine. The occurrence of a major fire event affecting grapegrowing regions would allow the collection of data and enable us to rectify this uncertainty in our knowledge. However, no such event has occurred (thankfully!) during the past two years while we have been conducting research in this area.

So, at this point in time, the approach is to compare the volatile phenol results (and bound phenol results, if necessary) with those of non-smoke-affected grapes

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and wines. If the results for the grapes or wine of a particular variety are lower than or equal to those considered to be typical 'background' levels for that variety, based on data collected over the past two years, then we can say it is unlikely there has been significant smoke exposure and hence there is a low risk of ending up with a smoke-affected wine.

If the levels are higher than the typical 'background' levels, then it is more difficult to predict the risk of a smoke-affected wine. In the case of wine analysis, the levels of the volatile phenols can be compared to the threshold levels mentioned previously in order to gain further data with which to assess the risk.

How much exposure to smoke is required to create a smoke taint effect in grapes and wine?

Research conducted by Kennison *et al.* (2009) showed that a single heavy exposure of grapevines to smoke is sufficient to result in smoke taint in wine, with the highest effect observed in wines corresponding to smoke exposure seven days post-veraison. This research also suggests that repeated or



prolonged exposure of a vineyard to smoke over the post-veraison period (in a single vintage) can potentially have a cumulative negative effect on resultant wine quality.

When is the best time to have samples tested?

The most effective time to test levels of volatile and/or non-volatile phenols in grapes is as close to harvest date as possible.

Any queries?

The members of the AWRI's Winemaking

and Extension Services team are available to discuss your particular circumstances and can be contacted on email: winemakingservices@awri.com.au or call 08 8313 6600

Ask the AWRI is a monthly column, which will focus on viticulture and oenology issues, in alternate months.

Reference

Kennison, K.R., Wilkinson, K.L., Pollnitz, A.P. Williams, H.G. Gibberd, M.R. (2009) Effect of timing and duration of grapevine exposure to smoke on the composition and sensory properties of wine. (*Aust. J. Grape Wine Res.*) 15 (3) : 228–237.



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