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# Technical notes

## Smoke taint remediation – R&D update

### Introduction

Toasty and smoky attributes, typically imparted by maturation in oak barrels, are often considered desirable characteristics in certain styles of wine. However, like many things in life, too much of a good thing can be detrimental. So, what happens when wine-grapes are exposed to smoke in the vineyard? Depending on the amount of smoke and duration of exposure, grapes can become ‘smoke tainted’ via absorption of aroma compounds present in smoke (e.g. the volatile phenols guaiacol, 4-methylguaiacol, syringol and cresol) through the grape skin into berries. To complicate matters, the volatile smoke aroma compounds can become bound to various sugar molecules contained within the grape to form non-volatile glycosides. The glycosides represent ‘stored’ smoky flavours that can later be released into the wine. To date the selective and comprehensive removal of smoke taint glycosides from juice or wine has been impossible.

Wines produced from smoke-tainted grapes are often described as exhibiting ‘an excessively drying back-palate and retro-nasal ash character’, making the wine unpleasant to consume. Since 2003, approximately \$400 million worth of grapes and wine have been lost or downgraded due to smoke taint in Australia. Thus it is important that the Australian wine industry manages this financial and reputational risk and develops cost-effective remediation tools for smoke-affected grapes and wine which minimise the expression of smoke taint characters and restore or retain wine quality.

### Rural R&D for Profit program

The Australian Government Department of Agriculture and Water Resources (DAWR), in collaboration with Wine Australia and the AWRI, recently funded a collaborative project on smoke taint as part of its Rural R&D for Profit program. This project is being carried out by the AWRI, Agriculture Victoria and La Trobe University, and addresses a range of gaps in current knowledge about smoke taint. The AWRI’s role is to evaluate a range of possible remedial management options and processing tools such as enzymes and fining agents for dealing with smoke-affected grapes and wine. In addition, the AWRI is collaborating with Agriculture Victoria and La Trobe University to evaluate vineyard-based monitoring, preventative and remedial management options as well as tools for dealing with the variable composition of atmospheric smoke and associated risk of smoke taint in wine.

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## **Smoke mitigation studies in the vineyard**

Vineyard mitigation experiments have been conducted to investigate whether it is possible to limit the uptake of smoke taint compounds into fruit by applying commercially available and registered horticultural products that are typically used as sprays in vineyards or orchards. This research was undertaken via a laboratory evaluation study using excised grape bunches in a controlled environment model system, where the grapes were exposed to a known gaseous mixture of phenols associated with smoke. Firstly, investigations focused on whether the excised wine-grapes (Chardonnay, Sauvignon Blanc and Semillon) and table grapes would absorb free phenols and subsequently convert them to their bound glycosidic forms. Results revealed that the berries in the excised bunches did take up and metabolise the volatile phenols, validating the set-up of the model system. Subsequently, 12 agrochemicals and horticultural products were evaluated using the excised bunch model system. The materials tested included oily/hydrophobic sprays, pest control products, sunscreen protectants and other solid materials that may provide a physical barrier. The effectiveness of the treatments in preventing uptake of free phenols by the grapes (Muscat Gordo and Shiraz) and their subsequent conversion to glycosides was evaluated by comparison to a non-treated control. Most treatments provided little if any protection, and instead often resulted in higher levels of free phenols and their glycosides in the grapes, with the highest levels being observed for the more oily/hydrophobic materials. These results suggest that at best only limited protection is likely to be achievable from applying preventative treatments to vineyards ahead of an anticipated smoke event, highlighting the need for more research into remediation options in the winery.

## **Smoke mitigation studies in the winery**

The AWRI's focus in 2017/2018 will be on developing strategies to treat smoke-affected juice and wine to minimise the expression of smoke taint characters and retain wine quality. Juice and wine remediation activities will initially focus on evaluating fining materials such as activated carbon and oxidative treatments (e.g. hyperoxidation of white juice) for the removal of phenols associated with smoke taint. A particular focus will be on the ability of fining and oxidative treatments to remove glycosides. Additional studies are planned using enzymes that can cleave the bound phenols, as phenols may need to be converted to their free forms before they can be effectively removed using existing technologies.

## **Sensory studies**

Sensory analysis of treated juice/wine will also be conducted to demonstrate the sensory impact of reducing the concentrations of key volatile phenols and their associated glycosides. In addition, trials have commenced to establish the effect of diluting smoke-tainted wine with 'clean' wine on the sensory perception of smoke taint in Chardonnay, Pinot Noir and Shiraz wine.

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## Real-world experiences with fining, oxidation and other winemaking approaches

The project team is very interested to learn from Australian winemakers about their experiences from past vintages – successful or not – with improving smoke-tainted juice and wine. Any winemakers who have used enzymes or fining agents to treat smoke-affected juice and/or wine are asked to get in touch. The team is also seeking smoke-affected grapes and wines from the from vintage 2017 and the upcoming 2018 vintage for use in winery mitigation experiments. Please contact Mark Krstic ([mark.krstic@awri.com.au](mailto:mark.krstic@awri.com.au) or 0437 325 438) or Julie Culbert ([julie.culbert@awri.com.au](mailto:julie.culbert@awri.com.au) or 08 8313 6600) if you can provide information about winemaking treatments trialled in the past or if you have smoke-affected grapes available or smoke-tainted wine in storage. The focus varieties for the project are Chardonnay, Pinot Noir and Shiraz, but fruit from other varieties is also of interest.

### Acknowledgements

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### Further reading

Krstic, M.P., Johnson, D.L., Herderich, M.J (2015) Review of smoke taint in wine: smoke-derived volatile phenols and their glycosidic metabolites in grapes and vines as biomarkers for smoke exposure and their role in the sensory perception of smoke taint. *Aust. J. Grape Wine Res.* 21(1): 537–553.

Wine Australia (2016) \$3 million to safeguard winegrapes from smoke. [https://www.wineaustralia.com/news/media-releases/\\$3-million-to-safeguard-winegrapes-from-smoke](https://www.wineaustralia.com/news/media-releases/$3-million-to-safeguard-winegrapes-from-smoke).

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