Smoke taint in wine

AGRICULTURE VICTORIA

Information sheet 1 of a series of 5

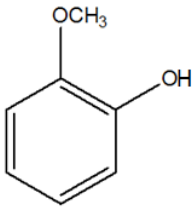
Grapes exposed to smoke from prescribed burning and bushfires can absorb compounds that are undesirable for wine making. Wines made from grapes exposed to smoke can exhibit bad aroma and off flavours (e.g. ashtray) that significantly downgrades the wine or makes it unsaleable. This is known as 'smoke taint'.

The phenolic compounds produced in smoke can be absorbed directly through the skins of berries and leaves but do not move greatly through the plant. These compounds exist in the berries and wine as free volatile compounds or as non-volatile compounds when they bind to sugars. Free volatile compounds contribute to both smoke aroma and taste in wine, whereas bound compounds are mostly related to taste. People differ in their taste of smoke taint compounds due to different enzyme release in the mouth during drinking.

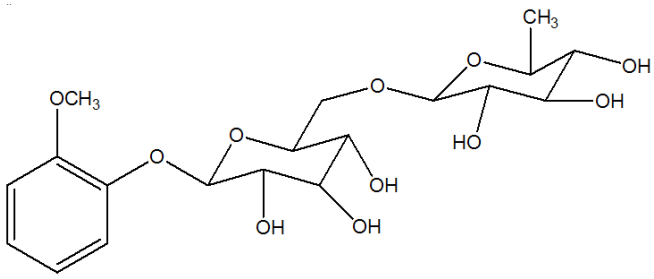
SMOKE TAINT COMPOUNDS

Studies have identified up to seven key volatile compounds most closely associated with smoke taint in wine. The key compounds are guaiacol, 4 methylguaiacol, m-cresol, o-cresol, p-cresol, phenol and syringol. The concentrations of these phenolic compounds in grapes and wine have been shown to be related to their concentrations in the smoke and the duration of smoke exposure.

When absorbed into grapes, a large proportion of each smoke taint compound is bound immediately to sugars inside the grapes to form non-volatile glycosides (Fig. 1). Later during winemaking, these bound forms can be released from the sugar molecule. Our studies have shown that after fermentation and once bottled, the free and bound forms stay relatively stable as long as storage temperatures are below 25°C.



Guaiacol (free)



Guaiacol rutinoside (bound)

Figure 1. The chemical structure of guaiacol (top) and guaiacol rutinoside (bottom) found in smoke affected grapes. Guaiacol is one of the key volatile compounds associated with smoke taint. Guaiacol rutinoside is a non-volatile compound formed in the grape after guaiacol is bound to a sugar molecule. Guaiacol rutinoside is less likely to be detected by sensory analysis.

WINEMAKING AND STORAGE

The process of winemaking can liberate some of the phenolic compounds from their bound forms, potentially resulting in the development of higher levels of taint in the wine. Furthermore, smoke taint compounds can be absorbed by leaves so it is important to minimize leaves in the ferment. Fortunately, taint compounds do not appear to move from leaves or other plant parts into grapes so the taint compounds do not carryover from one season to the next.

Skin on fermentation for red wines leads to a higher concentration of smoke taint volatiles in the wine than white wines; however, sensory thresholds for identifying smoke taint are much lower in white wines due to the reduced complexity of the wine.

Studies on both white (Chardonnay) and a range of red varieties exposed to smoke in the vineyard have shown that smoke taint compounds are relatively stable once in wine. There may be a small initial increase in the wine, but studies have shown little change over an 8 year period of storage. Further studies are required to be certain of the changes over time. Results do however show that the risk of taint developing during storage appears to accelerate dramatically at temperatures higher than 25°C.

TESTING FOR SMOKE TAINT

Ideally, grapes and wine should be tested for smoke taint by measuring both the free and bound forms to get an accurate indication of the total burden of smoke taint compounds, and the risk of the wine becoming tainted. DEDJTR's Centre for Expertise in Smoke Taint Research (CESTR) has developed a new method to determine both the free and bound forms and this has been used to improve thresholds for detection of smoke taint. This method is being evaluated against other methods to determine its usefulness to better predict smoke taint compounds in smoke, grapes and leaves, and wine.

Several laboratories in Australia, including the Australian Wine Research Institute (AWRI) offer commercial testing services for smoke taint compounds in grapes and wine. For advice regarding when and how to sample, and how to send samples for analysis, refer to https://www.awri.com.au/information_services/current-topics/smoke-taint/).

Consult with the laboratory for advice on the interpretation of test results; sensory thresholds vary between varieties due to differences in flavour complexity.

Note that sending fruit samples from a Phylloxera Infested Zone or a Phylloxera Risk Zone will require a Plant Health Certificate. For more information about Plant Health Certificates, contact a DEDJTR Plant Standards Officer on 136 186, email plant.standards@ecodev.vic.gov.au or visit http://agriculture.vic.gov.au/agriculture/horticulture/wine-and-grapes/viticulture-biosecurity.

CONCLUSION

If berries are at risk of being smoke tainted, it is advisable to test the berries for smoke taint compounds. Individual laboratories will have developed their own thresholds related to their form of testing so it is important to seek advice on whether the laboratory thinks the samples may be tainted. Wine should not be made from tainted berries.

Wine made from berries subjected to smoke, but tested to be taint free, may still show smoke taint after fermentation or develop smoke taint slowly during storage particularly if stored at temperatures above 25°C. In such cases where grapes have been subjected to smoke but show levels below the thresholds, wine should be tested for smoke taint compounds.

ACCESSIBILITY

For more information, please contact the Project Leader, DEDJTR Victoria – Centre for Expertise in Smoke Taint Research, Agriculture Research Branch on 136186.

This document is also available in PDF format at www.victoriangovernmentdepartment.vic.gov.au

First published: August 2016