



Treating smoke-affected wine with activated carbon



Background

When grapes are exposed to smoke, they can absorb volatile phenols, which bind to sugars in the grapes forming non-volatile phenolic glycosides. In juice and wine, both volatile phenols and their glycosides can cause unpleasant 'ashy' and 'smoky' sensory sensations and a lingering aftertaste, commonly described as 'smoke taint'.

What is activated carbon and how can it be used to mitigate smoke taint?

Activated carbon products are highly porous carbon-rich materials used in applications such as filtration and water treatment. They are known to adsorb organic compounds, including undesirable contaminants such as the volatile phenols and phenolic glycosides associated with smoke taint. Activated carbon products can be used to treat smoke-affected juices (white or rosé) or wines; however, they also remove positive colour, aroma and flavour compounds.

Generally, phenolic glycosides are more prevalent than volatile phenols in juices or musts, whereas smoke-tainted wines often contain a combination of both volatile phenols and phenolic glycosides. It is important to select the right carbon product for the desired application (e.g. one product might be better at removing phenolic glycosides and another at removing volatile phenols).



Performance differences among different carbon products

The efficiency of activated carbon products in removing smoke taint compounds is highly dependent on:

- (i) the type of carbon product used
- (ii) the matrix (e.g. juice versus wine; red versus rosé or white)
- (iii) the dose added.

Some activated carbon products are better at removing phenolic glycosides, and the removal occurs better in juice than wine. Other carbons preferentially remove volatile phenols in wine (Figure 1).

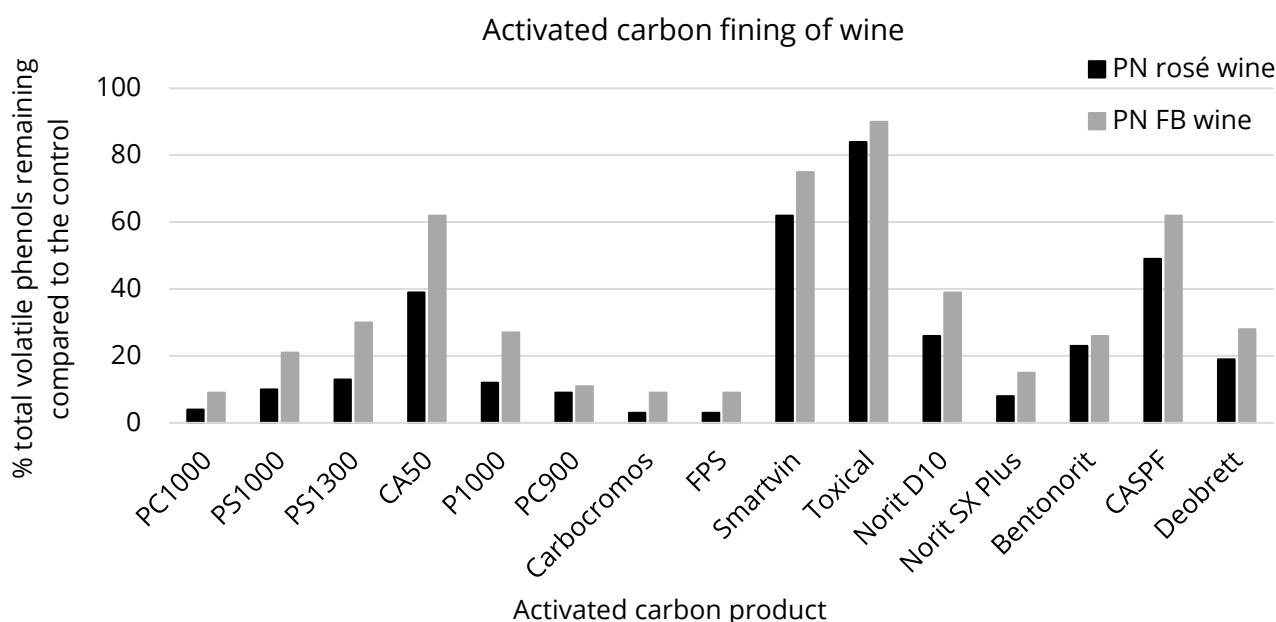


Figure 1. Comparison of the ability of 15 activated carbon products (dose 2 g/L, contact time 24 hours) to remove total volatile phenols (VPs) from 2019 smoke-affected Pinot Noir (PN) rosé and full-bodied (FB) wines. Results are presented as percentage of volatile phenols remaining compared to the control (i.e. wine without carbon treatment). Starting total volatile phenols (sum of guaiacol, 4-methylguaiacol, m-, o- and p-cresols, syringol and methylsyringol) for the rosé and full-bodied PN wines were 77 and 149 µg/L, respectively.

Assessing performance

The evaluation of the different activated carbon products was based on measurement of their ability to remove volatile phenols and phenolic glycosides from wine. For removal of volatile phenols from wine, Carbocromos super (Vason) and FPS (Vason) were among the best performers (Figure 1). Activated carbon products were not very effective at removing phenolic glycosides from wine. For example, for two full-bodied Pinot Noir red wines, the reduction in phenolic glycosides, at best, was less than 20%, even at a dose of 2 g/L (data not shown). The activated carbon products fared slightly better in white and rosé wines, with some removing between 50 and 60% of the



phenolic glycosides. Removal of phenolic glycosides is better performed in juice than in wine. Greater success was observed when using activated carbons to remove volatile phenols from wine.

Carbon treatment of wine

A 2019 smoke-affected full-bodied Pinot Noir wine was treated with PS1300 or FPS at doses of 1 and 2 g/L. Carbon contact time was 48 hours and wines were clarified with the assistance of bentonite. Wine treated with activated carbon showed a reduction in smoke taint sensory ratings (rated on a scale of 0 to 9, Table 1), with a more pronounced effect seen at higher carbon doses.

Table 1. Smoke taint ratings for 2019 smoke-affected Pinot Noir wine with no treatment (control) and treated with activated carbon products (FPS or PS1300) at two doses (1 and 2 g/L)

Control (no carbon)	FPS 1 g/L	FPS 2 g/L	PS1300 1 g/L	PS1300 2 g/L
6.2	2.8	1.5	2.7	1.6

Similar to smoke-affected juices, treating wine with activated carbon requires a balancing act between reducing smoky attributes while retaining desirable sensory attributes. Additions of activated carbons at less than 1 g/L might be appropriate in some wines to achieve this balance.

Recommendations/conclusions

The selectivity and tendency to protect desirable aromas and flavours might differ between carbon products and needs to be considered prior to carbon fining of wine. Furthermore, the appropriate carbon addition will be dependent on the level of taint compounds in the wine. Chemical analysis for volatile phenols and phenolic glycosides is therefore recommended.

It is recommended that evaluations of carbon treatments be performed on small volumes of wine to determine sensory impacts before treating larger quantities of wine. Further blending of carbon-treated wine with non-smoke-affected wine is another option to obtain a final wine with suitable sensory characteristics.

While all activated carbon products evaluated in this work were commercially available, it is also recommended that wineries contact product manufacturers to ensure that their product adheres to the relevant food standards code for use in wine production. Carbons suitable for treatment of water or other foods may not be appropriate for wine production. Note that the OIV recommends carbon additions should be less than 1 g/L for wine. Carbon fining rates are more typically around 500 mg/L. The addition of larger quantities of carbon (>1 g/L) to wine may remove excessive colour and flavours, making it appear un-wine-like. In addition, for some carbon types, the addition of larger quantities could result in the release of metal compounds into the wine.



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Acknowledgement

This work was supported by the AWRI, and through funding from the Australian Government Department of Agriculture, Water and the Environment as part of its Rural R&D for Profit program and Wine Australia. The AWRI's communications are supported by Australian grapegrowers and winemakers through their investment body Wine Australia, with matching funds from the Australian Government. The AWRI is a member of the Wine Innovation Cluster in Adelaide.

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