AWRI Australian Wine Research Institute

Fact Sheet
WINEMAKING

Treating smoke-affected grape juice 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 (Figure 1), and the removal occurs better in juice than wine.

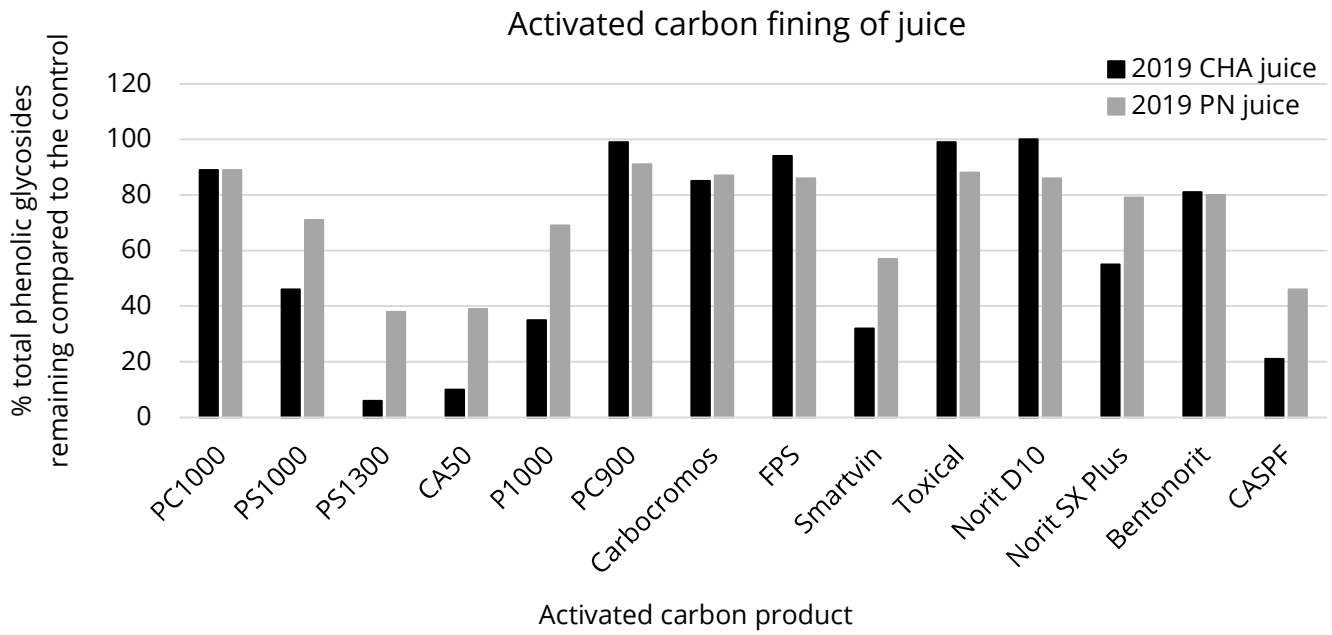

Figure 1. Comparison of the ability of 14 activated carbon products (dose 2 g/L, contact time 24 hours) to remove phenolic glycosides from two 2019 smoke-affected juices (CHA = Chardonnay; PN = Pinot Noir). Results are presented as percentage of phenolic glycosides remaining compared to the control (i.e. juice without carbon treatment). Starting concentrations of phenolic glycosides (sum of six common phenolic glycosides) for the CHA and PN juices were 251 and 335 µg/L SyGG equivalents, 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 juice. For removal of phenolic glycosides from juice, the products PS1300 (Activated Carbon Technologies), CA50 (Carbochem), smartvin (Vason) and Norit CASPF (Cabot) performed best, removing 90% of the phenolic glycosides or more. Overall, the activated carbon products were more effective at removing phenolic glycosides from juice than wine. For removal of volatile phenols from juice, Carbocromos super (Vason) and FPS (Vason) were among the best performers.

Impact of carbon treatment of juice on sensory characteristics of wine

Carbon treatment of juice

In an experiment assessing the sensory effects of carbon fining, 2019 smoke-affected Chardonnay and Pinot Noir rosé juices were treated, in duplicate, with one of two carbon products (PS1300 and CASPF) at 1, 2 and 4 g/L prior to fermentation. Carbon contact time was 48 hours and inoculation occurred after juices were clarified with the assistance of bentonite. For the Pinot Noir rosé wines, eleven attributes were rated by the panel as being significantly different (P<0.05, Figure 2).

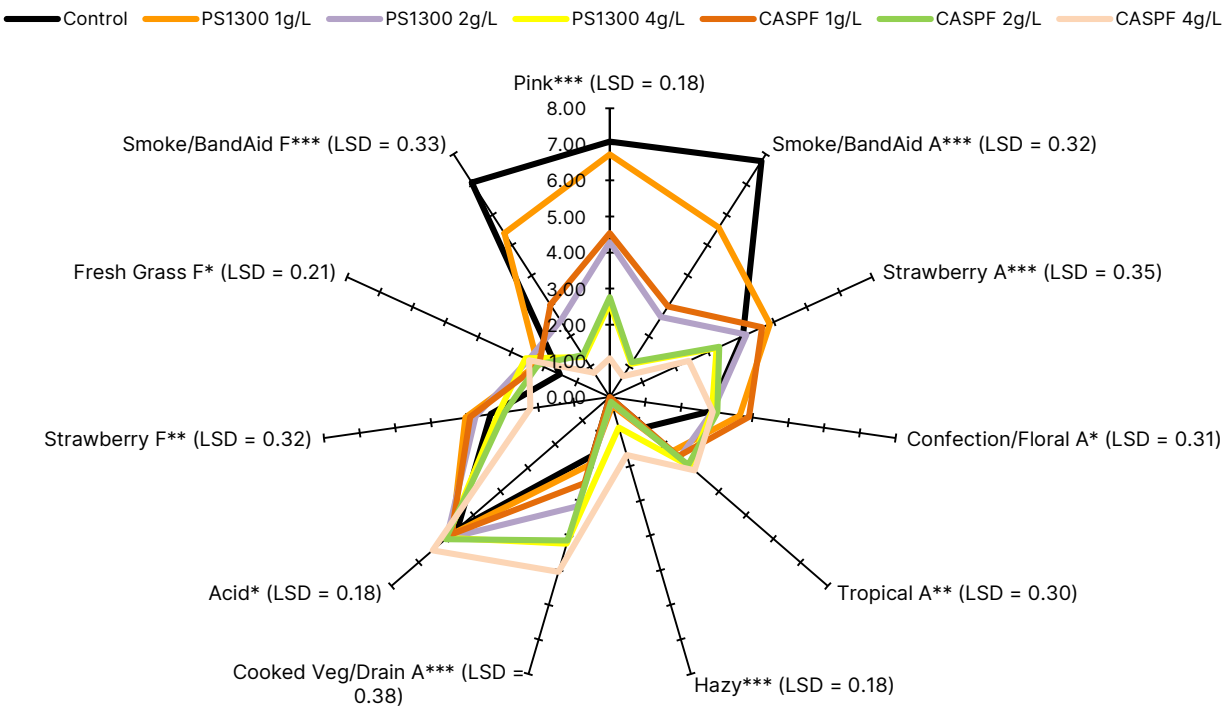

Figure 2. Mean attribute intensity scores for significant (*P<0.05; **P<0.01; ***P<0.001) and approaching significance (ǂ P< 0.10) attributes for six Pinot Noir rosé wines made from carbon-treated juice and one control wine. LSD (P=0.05) values included for the significant attributes (P<0.05)

All activated carbon treatments in the trial decreased the intensity of smoke-related characters in the final wines to some extent. However, particularly at the higher doses, the carbon treatments also reduced the intensity of many of the pleasant 'fruit/floral' attributes. The intensity of 'cooked veg/drain' aroma also increased with the higher concentration carbon treatments. The Pinot Noir rosé wines made from juices treated with 1 g/L of activated carbon had enhanced 'strawberry' aroma and flavour compared to the control while also having a reduction in smoke aroma and flavour.

The OIV recommends using carbon additions of less than 1 g/L for both juices and wine, with fining rates of 50 to 500 mg/L typically used for removal of odours. These results indicate that

using activated carbons to remove smoke characters from wine will always be a balancing act between reducing smoky aromas and flavours, while retaining some desirable sensory attributes.

Recommendations/conclusions

Smoke-affected juices (especially white and rosé styles) can be effectively treated with activated carbon products prior to fermentation to reduce the intensity of smoke characters in the wines made from treated juices. The impact of carbon fining must be closely considered as the intensity of positive sensory attributes will also be reduced.

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 juice.

The appropriate carbon addition will be dependent on the level of taint compounds in the juice. Chemical analysis for volatile phenols and phenolic glycosides is therefore recommended. Where possible, fruit should be analysed approximately two weeks before harvest, while undertaking in parallel mini-ferments of juice and/or carbon-fined juices followed by sensory assessment of the mini-ferments.

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 juice. Carbon fining rates are more typically around 500 mg/L. The addition of larger quantities of carbon (>1 g/L) to juice and wine may remove excessive colour and flavours, making the sensory characteristics of the resulting wine 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 juice.

Acknowledgement

This work was supported by Wine Australia, with levies from Australia's grapegrowers and winemakers and matching funds from the Australian Government. The AWRI is a member of the Wine Innovation Cluster in Adelaide, SA.

Contact

For further information, please contact:

AWRI helpdesk team

Phone 08 8313 6600 **Email** helpdesk@awri.com.au

Website https://www.awri.com.au/industry_support/winemaking_resources/smoke-taint/

Address Wine Innovation Central Building, Corner of Hartley Grove & Paratoo Rd, Urrbrae (Adelaide), SA 5064