



GUIDELINES TO REDUCE SMOKE TAIN IN GRAPES AND WINE

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What is smoke taint?

Harvesting grapes from vines that have been exposed to bushfire smoke can result in wines containing smoke taint, described as “smoky, burnt and ash” aromas and “cigarette, ash tray, acrid and burnt” flavours. Aroma compounds enter the vine by absorbing onto the protective waxy cuticle layer or moving into the stomata on leaves and thereafter finding their way through the phloem into grapes. Smoke taint can be attributed to the various volatile phenols (VPs) absorbed, with guaiacol and 4-methylguaiacol (4MG) being the most predominant compounds, and a number of other VPs contributing. These compounds can be found in grape juice and wine in free and glycosylated (linked to sugars) forms. The free form of a VP is odorous. Glycosylates are non-odorous but have ashy palate effects as VPs are released by in-mouth enzymes. VPs are not all bad. They can contribute positive characteristics like vanilla, woodiness and spiciness to the aroma (for example, when they are extracted from oakwood). Guaiacol can also be found naturally at very low levels in non-smoke exposed, non-oaked wines (notably Shiraz). The perception of smokiness from guaiacol is dependent on the aromatic intensity of the wine, with sparkling base showing smoky character at 6-10 µg/L of guaiacol, medium bodied red at 15-25 µg/L and full-bodied Shiraz at 30-40 µg/L. Smoke taint can thus be masked by the presence of other volatiles (e.g. from addition of oak extracts), which depends on wine style. Research conducted over the past few years has led to the development of guidelines on how to handle smoke tainted fruit.

Making wine to minimise volatile extraction and trying to minimise extraction of glycosylates at the same time, for early release or blending, is a sensible strategy. An alternative

winemaking strategy is to maximise release of VPs from glycosylates and remove them from the wine so as to avoid later release. Treatments that have been shown to significantly remove VPs are reverse osmosis (relatively expensive), activated charcoal (strips out a lot of other components including colour), and yeast hulls (not as efficient at removal but has shown some interesting results).

What is recommended for *minimising* smoke taint

- 1 **Hand harvest the grapes** – minimise the breaking / rupturing of skins as long as possible. It has been found that the VPs responsible for the smoke taint are more concentrated in and near grape skins, and any juice contact with skins may cause extraction.
- 2 If water supplies/restrictions allow, **a high pressure cold water rinsing of the grapes** once harvested will not affect the volatiles and glycosylated phenols already in the grapes, but it will help to remove excess ash and smoke particles that contribute to the “ashtray taste”. The grapes need to be allowed to drain and dry off afterwards.
- 3 **Remove leaves and other MOG** – it has been shown that leaves contain higher VP concentrations than grapes. Also, the combination of methoxypyrazines even at sub-threshold levels with volatile phenols has been shown to enhance “green” characters in red wine.
- 4 **Process grapes cool** – it has been shown that grapes processed at 10°C had less extraction than grapes processed at 25°C.

- 5 **Limit skin contact** – in the case of white grapes do whole bunch press and keep press fractions separate from free run juice. Only add enzymes after pressing to free run juice to improve settling. Use “purified from glycosidases” enzymes. A large proportion of the VPs occur in a non-odorous glycosylated form that can be hydrolysed by glycosidases naturally occurring in non-purified white wine processing enzymes.
- 6 In the case of red wine fermentation, **limit juice and skin maceration time**. Do not do cold soaking and do not do extended skin contact after fermentation. Do not use enzymes to improve extraction. Extraction enzymes, apart from extracting more VPs from skins, can also contain glycosidase side-activities, if un-purified.
- 7 **Fining with activated carbon** can effectively remove a large percentage of the VPs. Most activated carbons remove colour as well, a factor that should be kept in mind when using on red wine. **Combine with bentonite** to assist with flocculation of proteins and enzymes, as well as removal of carbon from the juice.
- 8 **Use fruit-aroma enhancing (for its masking effect), fast fermenting yeast strains** to limit skin contact in the case of red wine maceration. Avoid using yeasts with glycosidase activity and avoid using colour absorbing yeasts. Maintain high yeast viability with proper nutrition and temperature management – dead yeasts absorb colour.
- 9 **Malolactic fermentation (MLF)** will generally release VPs and enhance phenolic characters so **should be avoided**. If you really must do MLF, use a starter culture that does not have glycosidase activities as this too can release glycosidically bound smoke-derived volatiles in wines. Do not do spontaneous MLF as most naturally occurring bacteria do contain glycosidase activities.
- 10 **Rosé wines have lower VP levels than red wines produced with the same grapes/juice**, due to less skin contact and no MLF. Winemakers should consider producing rosé wines of suspected smoke tainted grapes.
- 11 Consider the **addition of oak extracts** or fermentation/finishing tannins. The addition of oak and tannin actually increases smoky VPs, but the contribution of oak lactones, vanillin and hydroxyl-methyl-furfural increases complexity and thereby mask the smoky taints. Recent research has shown that **oak extracts definitely have a masking effect** and can help disguise VPs and smoke taint in the short term (at least a year). The long-term efficacy is currently being explored.
- 12 **Reverse osmosis and solid phase adsorption of wine** – this technique has been proven to be effective in removing a large percentage of smoke-derived VPs.

However, it also removes oak-derived VPs and diminishes fruity aromas.

- 13 **Do not blend smoke tainted wines with non-smoke tainted wines** unless they have been treated for VP removal. Fruity aromas associated with young wines diminish over time and thus their masking effect of smoke aromas diminishes. Non-odorous glycosylated VPs can also be hydrolysed over time via chemical hydrolysis, releasing the odorous VPs. This means a blend that seemed fine initially could become problematic over time.
- 14 **Market the wine for early consumption** for the same reasons mentioned above. Wines that were acceptable for consumers at bottling could become non-acceptable six or 12 months down the line.

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