

Response to Wildfire Impact on CA Wine Industry and Smoke Taint

*by Anita Oberholster, Ph.D., Cooperative Extension Specialist in Enology,
Department of Viticulture and Enology, University of California, Davis*

Firstly, our thoughts are with those impacted by the current wildfires in northern California. Please contact us if we can be of service in any capacity.

We would like to place the impact of the current wildfires on the grape and wine industry in to perspective as well as share what is known and not known about smoke taint. It is important to note that by the time the wildfires started on Sunday evening, most of the grapes had already been picked. Estimates are that close to 90% of the grapes were picked although this number may vary depending on the location. That means that only a small percentage of the 2017 grape harvest may be potentially impacted by the wildfires and smoke.

Grapevines are very resilient and do not burn easily. In many cases the vineyards are acting like fire breaks and are likely playing a role in the fact that only a limited number of wineries have been destroyed or significantly damaged in the fires surrounding them. We expect that the grapevines will recover fully if they did not actually burn, although yield may be slightly impacted. Also, even if the grapes were impacted by what we call smoke taint, there is no carry over to the next season. Studies to determine the amount of smoke exposure needed to result in smoke taint are still underway. The risk of smoke taint increases with continual exposure or repeated exposures of heavy smoke. Exposure to heavy smoke has the potential to be problematic. We advise that wineries test their grapes to determine potential risk. The heavy winds would have decreased the risk of smoke taint developing due to removal of the smoke.

Smoke taint in grapes and wine: Since most of the grapes were harvested before the fire, smoke taint for this harvest will be limited. Only the grapes still in the vineyard may potentially be affected. There is no data, but we do not expect smoke to be a problem in wineries. Fermenting wines will be protected by the released carbon dioxide and finished wines should be sealed to protect them against any smoke that may enter the winery.

Smoke Taint Science: Research has found that there is a substantial increase in the levels of certain aroma compounds such as free guaiacol and 4-methylguaiacol in wine made with smoke-affected fruits. These compounds are present in wood smoke resulting from the pyrolysis (thermal decomposition) of lignin and result in high levels of overpowering smoky, cold ash characters in a wine. They also increase during bottle aging, apparently due to acid hydrolysis of glycosidically bound volatiles. It appears that volatiles such as guaiacol and 4-methylguaiacol can be absorbed through the berry skins and be glycosylated within. Basically the compounds are bound to sugars in the grapes making them non-volatile. However, over time these bonds can hydrolyze in the resulting wine, as wine is an acidic medium (pH of 3 to 4), and when this happens these compounds do become volatile, contributing to aroma and thus potential off-flavors.

The phenological timing of grapevine smoke exposure influences the severity of the taint in the wine. Grapes are the most susceptible to smoke taint from after veraison (color change for red grapes) to harvest. However, as previously mentioned, no carry-over are found for smoke constituents the following season. Studies have shown that smoke-derived volatile phenols can be absorbed both directly

via the berry cuticle and via the leaves and translocated to the fruit. Thus, defoliation of grapevines following smoke exposure can reduce the severity of smoke taint in grapes and wine, but washing the grapes prior to processing has no impact on potential smoke taint development. In addition, leaves should be removed from grapes prior to processing. All cultivars studied (Chardonnay, Cabernet Sauvignon, Grenache, Merlot Pinot noir, Pinot Gris, Sangiovese, Sauvignon blanc, Syrah etc.) were impacted by smoke exposure.

Should smoke taint be found in a resulting wine, several treatments can mitigate the effects. Most fining agents reduce the amount of smoke-derived volatile phenols and the wines studied exhibited less intense smoky characters. However, most fining agents lack specificity, meaning they will also remove compounds other than taint compounds and could impact wine quality. Activated carbon is seen as being the most effective fining agent. Similarly both reverse osmosis and solid phase extraction significantly reduced the amount of smoke-derived compounds. Unfortunately, the taint slowly returns after these treatments due to the hydrolysis of glycoconjugated precursors, which are not removed during treatment. Although grapes and wines can be tested for smoke taint compounds, it varies in its ability to predict the formation of different sensory characteristics related to smoke taint. The best predictions were obtained with analyzing guaiacol, 4-methylguaiacol, 4-methylsyringol, and *o*-, *p*- and *m*-cresol.

Different winemaking processing methods may also be used to minimize the impact of the smoke taint derived compounds. In general, reducing skin contact, using yeast strains to maximize the fruity characters in the wine and excluding press fractions, help decrease the apparent taint. Additionally, the use of oak chips and tannin enhances the complexity of the wines and decreases the perception of smoke-related attributes. However, it is advised to stay away from any barrel/oak toast profiles that may give additional smoke characters to the wine. These techniques may be helpful when a low level of smoke taint is present.

When a wine is affected by smoke taint, there is no perfect solution for removal. However, there are things you can do to minimize the impact of the smoke-derived compounds. Adapting winemaking protocols can limit the amount extracted into the wine and treatments after winemaking can reduce the free volatiles but not the precursors which can be released continuously during wine aging.

In summary: even though the grapes can be analyzed to determine the potential risk of smoke taint in wines, the predictive ability is not 100% due to synergistic and matrix effects. It is more an indicator to use care when processing the grapes and not introduce any element that can add additional smoky character. It is important to note that the compounds that are responsible for smoke taint, are naturally present in the grapes at low levels and that they are also part of the pleasant aroma compounds that are released into the wine during barrel aging. Toasting the barrels (oak) have a similar impact and releases volatiles such as guaiacol and 4-methylguaiacol into the wine. At low levels it adds complexity to the wine. It is only at very high levels that it will be seen as a fault or taint and can decrease the quality of the wine.