ask the AWRI

Thinking about pinking

The AWRI helpdesk has recently observed an increase in cases of pink colour development in 2022 vintage white wines soon after bottling, particularly in white wines made using ‘reductive’ winemaking practices. Affected producers have asked AWRI Oenologist Ben Cordingley questions about why this is occurring, how to best determine pinking susceptibility in these types of wines and the most appropriate prevention and/or treatment options.

What is the cause of pinking?

Pinking is the unwanted development of pink colouration in white wine due to the release of grape-derived red pigments from colourless precursors. It is a phenomenon that is often linked to 'reductive' white winemaking practices that limit the exposure to oxygen during their production.

It has previously been reported that pinking is caused by the conversion of colourless flavene molecules to red-coloured flavylium ions in the presence of oxygen. Other authors have more recently postulated that that pink colour development is caused by anthocyanin (Cosme *et al.* 2019). Anthocyanin is the same phenolic flavonoid compound that gives red wine its colour and it has been found in low concentrations in many white grape varieties. In white grapes and wines containing sulfur dioxide (SO_2), any anthocyanin will be present in an equilibrium between the free pigmented form and a colourless form that is weakly bound to the bisulfite form of SO_2 (i.e. anthocyanin and bisulfite ion form an addition compound called a hydroxysulfonate). The colourless hydroxysulfonate form of the anthocyanin is referred to as a pinking precursor. It is likely that when SO_2 concentration decreases due to oxygen exposure at bottling, there is an equilibrium shift leading to the release of coloured anthocyanin from the colourless hydroxysulfonate precursor.

How does anthocyanin end up in a white wine?

All white grape varieties have black-skinned ancestors and most still contain the genes required for anthocyanin production. The production of anthocyanin is a multi-step biosynthetic pathway involving several genes that when turned on or 'expressed' lead to the production of enzymes that build anthocyanin. In white grapes, the genes for anthocyanin synthesis (and associated regulatory genes) contain mutations that cause the production of anthocyanin to be much lower than in black grapes. Anthocyanin production in white grapes is also variety dependent. Pink-skinned varieties (such as Gewürztraminer) contain hundreds of times lower concentrations of anthocyanin than black grapes, and white-skinned varieties contain thousands of times lower concentrations (Arapitsas *et al.* 2015).

Why are pinking issues more prevalent in some years?

Environmental conditions and vineyard management practices influence the regulation of many genes in grapevines, which contribute to grape chemical composition. Low temperatures and exposure to sunlight can increase the expression of grape anthocyanin genes (Azuma 2018). It is possible that the cooler growing season and conditions of 2021/22 resulted in greater expression of anthocyanins in some white varieties, leading to a greater risk of pinking as observed this year.

Is the red colour that develops from the addition of phosphoric acid to a white juice during SO2 analysis a valid method to determine the risk of pinking?

There is currently insufficient data to establish a link between the intensity of red colour observed during this test and the real risk of pinking. Reducing the pH of a white wine should result in the release of some anthocyanin from precursor molecules and therefore an increase in the red colour intensity. An observation of this effect could perhaps best be used as a prompt to conduct further analysis of pink colour, pinking susceptibility and precursor content as described by Simpson (1977). The AWRI website contains further details on pinking analysis.

What is the best way to treat wines that are susceptible to pinking?

The risk of pinking can be reduced prior to bottling by fining with polyvinylpolypyrrolidone (PVPP). PVPP can remove low molecular weight phenolic compounds including free anthocyanin and its colourless precursors. When compared to other fining agents sometimes used to reduce colour, such as activated carbon or casein, the selectivity of PVPP makes it effective at lower addition rates with less sensory impact.

How does ascorbic acid help reduce pinking risk?

Ascorbic acid added at bottling has been observed to lower the risk of pinking. The mechanisms that give ascorbic acid a protective effect specifically against pinking are not clear. Ascorbic acid causes a lowering of redox potential, which makes reduction reactions more favourable than oxidation reactions. If pinking is due to anthocyanins rather than flavenes, then there is no evidence that maintaining a low redox potential would prevent the release of anthocyanin from pinking precursors. It has also been suggested that the lowering of redox potential caused by the addition of ascorbic acid is only temporary and might eventually result in an increase in redox potential greater than if the wine had not received the addition (Peng 1998).

A direct interaction between ascorbic acid and anthocyanin has been demonstrated in model systems to result in the mutual degradation of both compounds (West 2013). This has not yet been demonstrated in wine, where SO2, metal ions and other wine components could potentially influence this mechanism.

When adding ascorbic acid to a white wine, an appropriate excess of SO_2 is required. Ascorbic acid is a strong antioxidant which can react rapidly with oxygen to generate hydrogen peroxide. SO_2 reacts rapidly with oxidation-derived hydrogen peroxide that could otherwise cause browning in wine.

If you have a wine affected by pinking or require further information on testing and treatment of pinking, please contact the AWRI helpdesk on helpdesk@awri.com.au or 08 8313 6600.

References

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