How do tannins clean up stinky wine?

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Background

- Volatile sulfur compounds (VSCs), such as hydrogen sulfide (H_2S), methanethiol (MeSH) and ethanethiol (EtSH), are associated with 'reductive' aromas in wine.
- 'Stinky' sulfurs are often produced during winemaking and can negatively affect wine aroma, perceived quality and consumer preference.
- Winemakers use a range of prevention or remediation strategies, some of which are selective in their action, while others can sometimes exacerbate the sulfur compounds' negative impacts.
- Anecdotal evidence suggests that oenological tannins can decrease 'reductive' characters in wines, yet there is a research gap regarding how this might work.
- During wine oxidation, nucleophilic addition of quinones with a variety of electrophiles, including VSCs, has been suggested as a possible mechanism.

Research questions

- Can oenological tannins be used to remediate 'reductive' aromas?
- What is the mechanism for their removal of VSCs?

Experimental design

1. **To evaluate whether tannin products have the ability to remove VSCs**
   Oxygen-free model wine containing copper (0.3 mg/L) and iron (2.5 mg/L) was treated with H_2S, MeSH and EtSH (50 µg/L each) and high levels of two commercially available oenological tannins, Tannin V and Tannin Q (200 mg/L each) (Figure 1).
2. **To evaluate the products ~~are~~ formed when tannin products are used to remediate 'stinky sulfurs'**
   A 1:10 molar ratio of tannin:sulfur compounds (MeSH and EtSH) was added to model wine containing copper (0.3 mg/L) and iron (2.5 mg/L) (Figure 2).
3. **To demonstrate the scalping of VSCs and the subsequent formation of tannin-VSC adducts**
   Model wine containing copper (0.3 mg/L) and iron (2.5 mg/L) was treated with MeSH and EtSH (5 mg/L each) and with two commercially available oenological tannins, Tannin V and Tannin Q (100 mg/L each) (Figure 3).

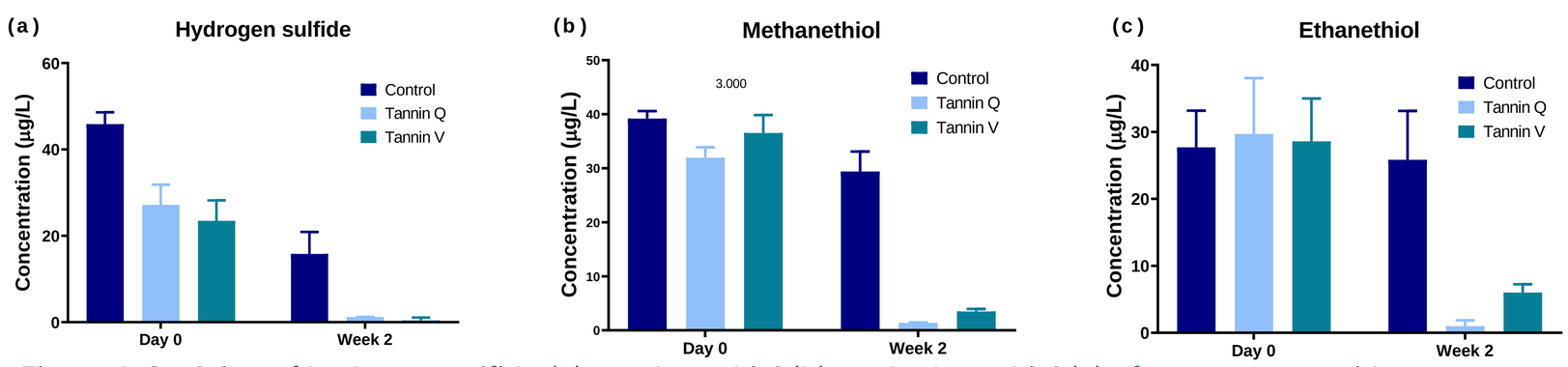

Figure 1. Scalping of hydrogen sulfide (a), methanethiol (b), and ethanethiol (c) after treatment with two commercially available tannin products (Tannin Q and Tannin VR)

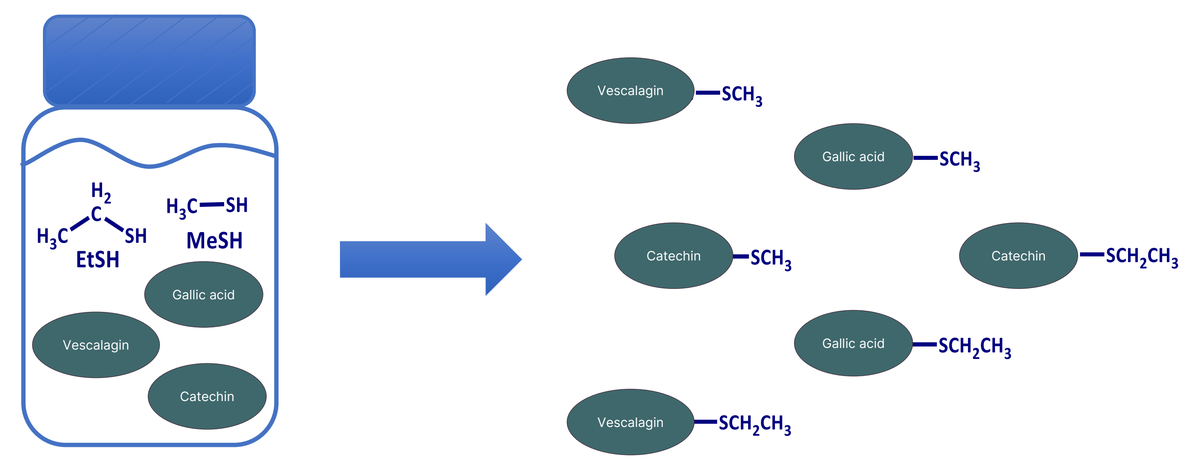

Figure 2. Oxidation reaction products formed when commercial tannin products (Tannin V and Tannin Q) were combined with methanethiol (MeSH) and ethanethiol (EtSH) in model wine (determined by high-resolution mass spectrometry)

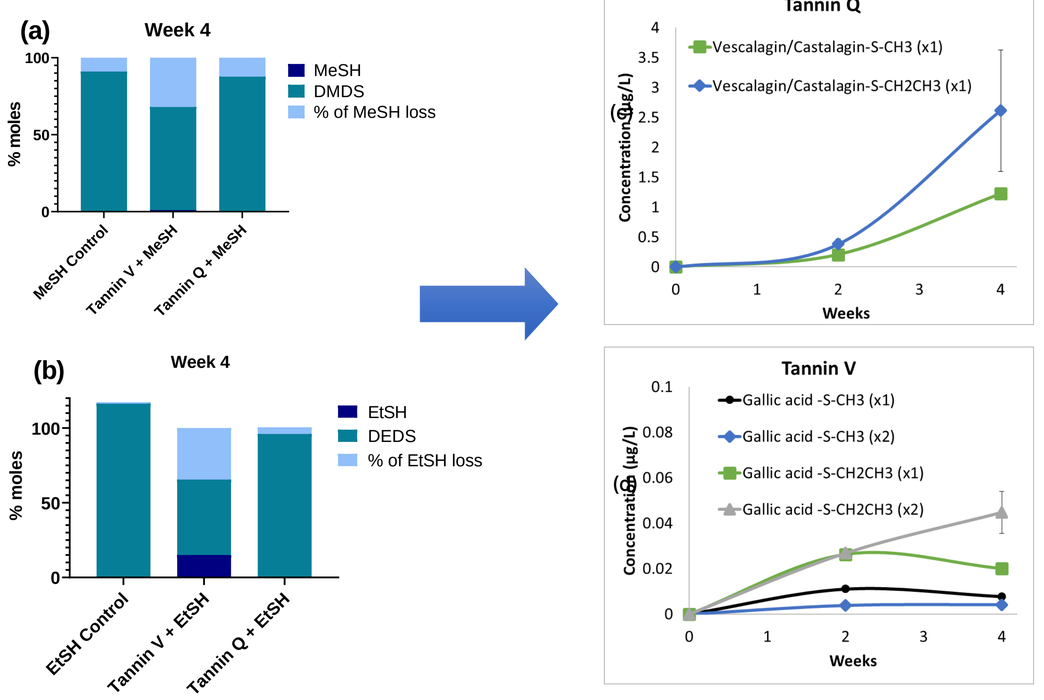

Figure 3. Effect of tannin addition on the decrease of methanethiol (a) and ethanethiol (b) measured after four weeks, as well as the subsequent formation of tannin adducts with methanethiol (c) and ethanethiol (d) in model wine.

Results

- The evaluated tannin products significantly decreased H_2S, MeSH and EtSH concentrations (Figure 1).
- Treating 'reductive' aromas with Tannin Q resulted in the greatest decrease in H_2S, MeSH and EtSH concentrations (Figure 1).
- Catechin, vescalagin and gallic acid adducts of MeSH and EtSH were produced in model wine containing a 1:10 molar ratio of tannin:VSCs (Figure 2).
- When tannin was present at wine-relevant concentrations, decreases in MeSH and EtSH concentrations were observed and a subsequent increase in gallic acid and vescalagin adducts with MeSH and EtSH was measured (Figure 3).

Take-home message

- These results demonstrated that the mechanism for scalping of VSCs by tannins is through the formation of oxidation reaction products with the sulfur compounds.

Wine Australia

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