The formation and fate of volatile sulfur compounds in wine during bottle ageing

Neil Scrimgeour, Marlize Z. Bekker, Eric N. Wilkes
The Australian Wine Research Institute, PO Box 197, Glen Osmond (Adelaide) SA 5064, Australia
Corresponding author’s email: neil.scrimgeour@awri.com.au

Introduction

The concentration of volatile sulfur compounds (VSCs) in wine can change significantly during bottle ageing. These compounds can impact on wine aroma and are generally perceived as negative attributes. Trials show that the concentration of transition metals can affect the evolution of VSCs post-bottling. The chemistry involved is relatively complex, leading to erratic and non-linear concentration changes over time.

The (simplified) chemistry involved

In bottle, the development of VSCs is governed by a complex range of factors including:
- Presence and speciation of metal catalysts such as copper and iron
- Quantities and types of active phenolic compounds and antioxidants
- Levels of SO₂ available
- Wine pH
- Storage temperature
- The initial oxygen introduced at bottling
- The oxygen available during the maturation process.

The interplay of these factors results in a complex series of equilibria which vary with time. As such the development of VSCs tends to be non-linear.

Important VSCs

The three VSCs below (shown with their aroma thresholds) are the most important during bottle ageing.

- Hydrogen sulfide (H₂S) 1 µg/L
  - Rotten egg, sewage-like
- Methanethiol (MeSH) 1.8-3.1 µg/L
  - Rotten cabbage, burnt rubber, putrefaction
- Dimethyl sulfide (DMS) 20-25 µg/L
  - Blackcurrant, cooked cabbage, asparagus, canned corn

Observations from bottle ageing trials

Aerobic vs anaerobic phase

Transition metals, such as copper, play a significant role in VSC formation in an anaerobic environment. Oxygen introduced at bottling can take up to three months to react with other wine components, delaying the onset of these changes.

Impact of pH

pH can have a synergistic effect with transition metals, such as copper, in determining the concentration of VSCs over time.

Impact of closure

Different closure types can influence the concentration of VSCs, especially over long-term storage periods, where differences in total concentration of oxygen consumed are significant. However, changes in the underlying wine chemistry are often more significant than the impact of the closure.