NOMA Sense™

by NOMACORC

Technical Letter | 03

Do different wines need different closures? The importance of combining glutathione and closure OTR for optimal wine aroma expression

Maurizio Ugliano

During bottle ageing, the aroma of wine changes, due to the combination of several chemical reactions. Among these, oxidative reactions are of primary importance in the process of wine maturation in the bottle. In the case of wines with strong varietal aroma characters of passion fruit and box tree, such as for example Sauvignon Blanc, excessive oxidation can result in loss of these pleasant attributes. This is due to the degradation of some sulfur compounds that are crucial to the aroma of these wines, including the powerful aroma compound 3-mercaptohexanol (3MH). In the modern wine industry, there is a strong trend towards the adoption of winemaking practices that allows the preservation of 3MH during bottle ageing, to ensure longevity of varietal fruity aromas. Protection of must from oxygen during pressing is one frequently adopted practice, and careful management of oxygen ingress during bottling operation is absolutely essential to ensure wine aroma longevity. More recently, several studies has shown that the levels of the natural wine antioxidant glutathione are a key factor in the aroma longevity of white wines. Glutathione is a powerful antioxidant that is naturally present in grapes. Detailed information on glutathione in wine can be found in the list of publication reported at the end of this article. The major points regarding glutathione are summarized below:

- Glutathione increases during grape maturation
- Grapes containing high assimilable nitrogen typically contain high glutathione
- During processing of grape must, glutathione can be rapidly lost if adequate antioxidant protection is not taken. Pressing under inert gas maximize glutathione preservation in the must
- During fermentation, glutathione is initially assimilated by the yeast, to be released later towards the end of fermentation
- Yeast strain affects the concentration of glutathione in the wine
- Ageing of the wine in contact with yeast lees strongly increases wine glutathione content
- Some fermentation supplements contain glutathione. Their use will therefore increase wine glutathione content. Winemakers should be aware of the glutathione content of any supplement that they use.

Glutathione in one of several other antioxidants commonly used in enology, such as SO_2 and ascorbic acid. However, its reduction potential is approximately five and three times higher than that of SO_2 and ascorbic acid respectively, which make glutathione a much more powerful antioxidant. In addition, glutathione acts directly on quinones, which are the main agent of the losses of 3MH during wine ageing. As it can be seen in Figure 1, from a recent study carried out by Nomacorc and The Australian Wine Research Institute (AWRI), increased levels of glutathione at bottling reduce losses of 3MH during ageing, ensuring higher concentrations of this fruity aroma compound after a period of bottle storage.

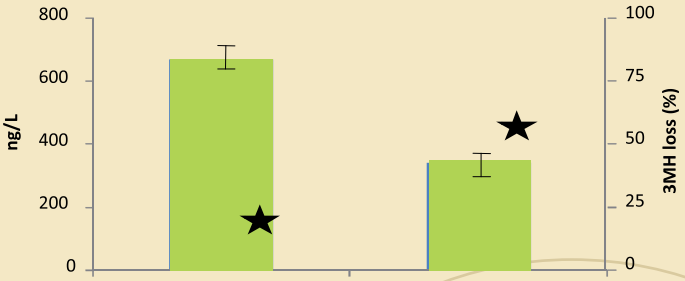

Figure 1. Influence of glutathione on the concentration of 3MH after 6 months of bottle storage. Stars indicate % loss compared to bottling.

Based on this, we can assume that, if we only look at wine longevity from the point of view of 3MH, a combination of high glutathione levels at bottling and selection of a closure with minimum oxygen permeability should ensure optimal longevity. In this sense, recommended concentrations of glutathione vary between 10 and 20 mg/L, but in some wines levels even higher that 30 mg/L have been reported. However, fruity sulfur compounds such as 3MH are not the only group of sulfur aroma compounds present in wine. During bottle ageing, other sulfur compounds such as hydrogen sulfide (H_2S) and methyl mercaptan (MeSH) can develop in the wine, imparting unwanted aroma attributes of rotten, cabbage, and cooked vegetables. These aroma characteristics are often defined as 'reduction', which often is

Nomacorc SA | ZI Les Plénesses | Chemin de Xhénorie 7 | B-4890 Thimister-Clermont | Belgium | Tel : +32 87 63 88 20

also perceived as lack of aromatic expression, due to the masking effect of these aromas on positive fruity attributes. Reductive wines are often also described as having a metallic taste. Figure 2 shows the influence of glutathione on H_2S and MeSH concentration after six months of bottle storage. When higher concentrations of glutathione are present bottling (20 mg/L were used in this study), the wines accumulated higher amounts of H_2S and MeSH, which indicate higher risk of reduction off-flavors. Noteworthy, in wines added with glutathione, H_2S was found at concentrations more than twice as high as its odor threshold in white wine.

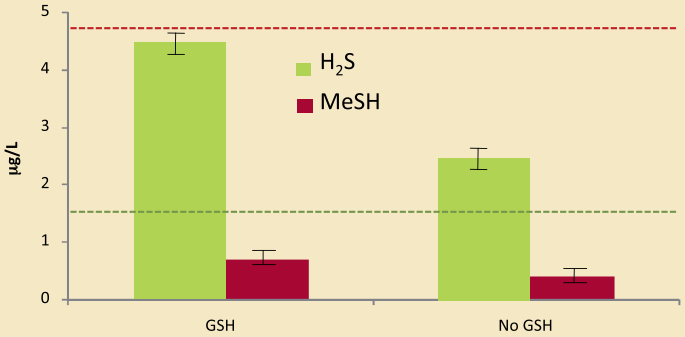

Figure 2. Influence of glutathione on the concentration of H_2S and MeSH after 6 months of bottle storage. Dashed lines indicate odor threshould in white wine

Therefore, although higher glutathione at bottling can prevent premature loss of fruity aromas, the risk exists for wines bottled with high levels of glutathione to develop reductive aromas that can mask the expression of varietal fruit characters. This might become even more problematic in wines with more neutral aroma profiles than Sauvignon blanc (e.g. Semillon, Pinot grigio, Chardonnay) where varietal fruity aromas are less dominant and reduction can be perceived more prominently. Under these circumstances, selection of an appropriate OTR offers an additional tool to tune wine aroma development in the bottle, with the possibility of achieving a balance of fruity versus reductive aroma compounds tailored to the need of each wine. This is illustrated in Figure 3. Wines with a lower content of glutathione developed small amounts of H_2S and MeSH, indicating a lower propensity to develop reduction even when sealed with a closure allowing minimal oxygen exposure. At the same time, due to the lower glutathione levels, these wines are more exposed to the risk of premature loss of fruity aromas. In this case, a low OTR closure can be chosen in order to compensate for the risk of premature loss of varietal fruity aromas. Conversely, in wines with higher glutathione content, while varietal fruity aromas are better preserved, the risk of reductive characters is increased. In such instances, winemakers could consider a closure with a slightly higher OTR, in order to decrease accumulation of reductive aroma compounds (Figure 3).

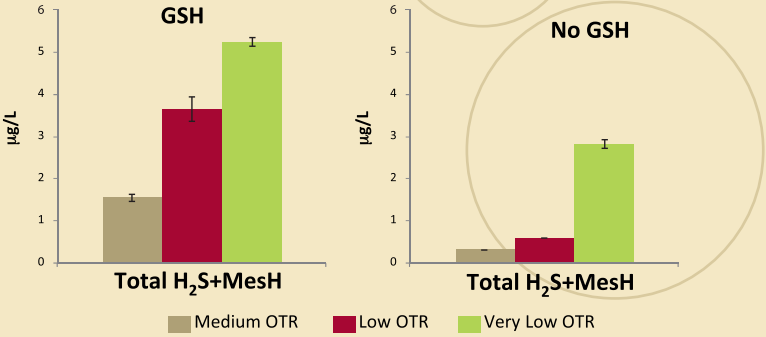

Figure 3. Effect of glutathione and OTR on the concentration of total reductive compounds (H_2S + MeSH) in Sauvignon blanc wines after 6 months of bottle storage.

Choosing a closure with an OTR that matches the oxygen requirements of the wine becomes therefore crucial to achieve optimal expression of fruity aromas, without developing reduction notes. The balance between varietal fruity aromas and negative reduction off-odours in is one critical aspect of oxygen management strategies, which Nomacorc has been studying extensively in collaboration with different research institutes. Winemakers that are aiming at improving aroma longevity of their wines by means of increased glutathione content might want to consider closures allowing low but sufficient exposure to oxygen in the bottle, such as the newly released Nomacorc Select 300.

Suggested readings

1. *Du Toit, W. www.wynboer.co.za/recentarticles/200712oxygen.php3*
2. *Bowyer, P.K., Murat, M-L., Moine-Ledoux, V. www.practicalwinery.com/mayjun10/aroma1.htm*
3. *Enology notes #129. www.fst.vt.edu/extension/enology/EN/129.html*
4. *Dubourdieu, D., Lavigne-Cruege, V. http://www.infowine.com/default.asp?scheda=1148*