Repetitive oxidation of Sauvignon blanc wine: Comparison of chemical and sensory data

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INTRODUCTION

The shelf life of especially white wine is of great concern for the wine industry. Oxidation may play an important role in white wine's composition and its sensory characteristics. During oxidation, a decrease in certain aroma compounds occurs followed by a change in wine colour. The change in aroma will typically result in the wine initially losing some of the varietal character after which an increase in unwanted oxidation aroma compounds such as aldehydes will occur.

The effect of oxygen and aging on various aspects of dry white wines have been investigated (1-4) and the evolution of wine sensory quality is thought to reach a peak after a period in the bottle, however the time period necessary and the amount of oxygen required to reach this peak remain unknown. Understanding a wine's oxygen capacity enables the winemaker to control wine evolution in the bottle by choosing the optimal closure in accordance with the desired wine style and shelf life.

This study monitored Sauvignon blanc wine evolution in a controlled environment after which both chemical and sensory analysis were performed. Successive mild oxygen additions were applied and oxygen concentrations were specifically measured while the wines were kept at a mild temperature over a long period of time. Frequent sampling also allowed the investigation of the evolution of the aromatic and non-aromatic compounds during the time of the study and the inclusion of sensory data at each of these stages provided a comprehensive assessment of wine oxidative aging in terms of chemical composition and sensory effects.

EXPERIMENTAL PROCEDURE

- Commercial wine obtained just after 2011 harvest
- Wine divided into 4.5 L bottles (Figure 1) - triplicate
- No oxygen added to Control samples (Table 1)
- Oxygen added according to specified treatments (Ox), process repeated once all oxygen was consumed
- Wine stored in the dark at 15˚C at all times
- Sensory and chemical analyses were done once all the samples was collected
- Descriptive analyses - 12 Judges, 8 training sessions, 6 testing sessions

Treatment example:

–T1 Ox was oxygenated only once and the sample was frozen (-20˚C) after oxygen was consumed. All other treatments was oxygenated again thereafter.

–T5 Ox was oxygenated at 5 stages to reach a consumed oxygen level of 30 mg/L.

Table 1. Treatment and total amount of oxygen dissolved

Treatment and days aged	Dissolved oxygen concentration (mg/L) Control	Ox
T0 (0 days)	0	
T1 (64 days)	0	7
T2 (148 days)	0	12
T3 (190 days)	0	17
T4 (204 days)	0	22
T5 (218 days)	0	30

Figure 1. Oxygen sparging

RESULTS AND DISCUSSION

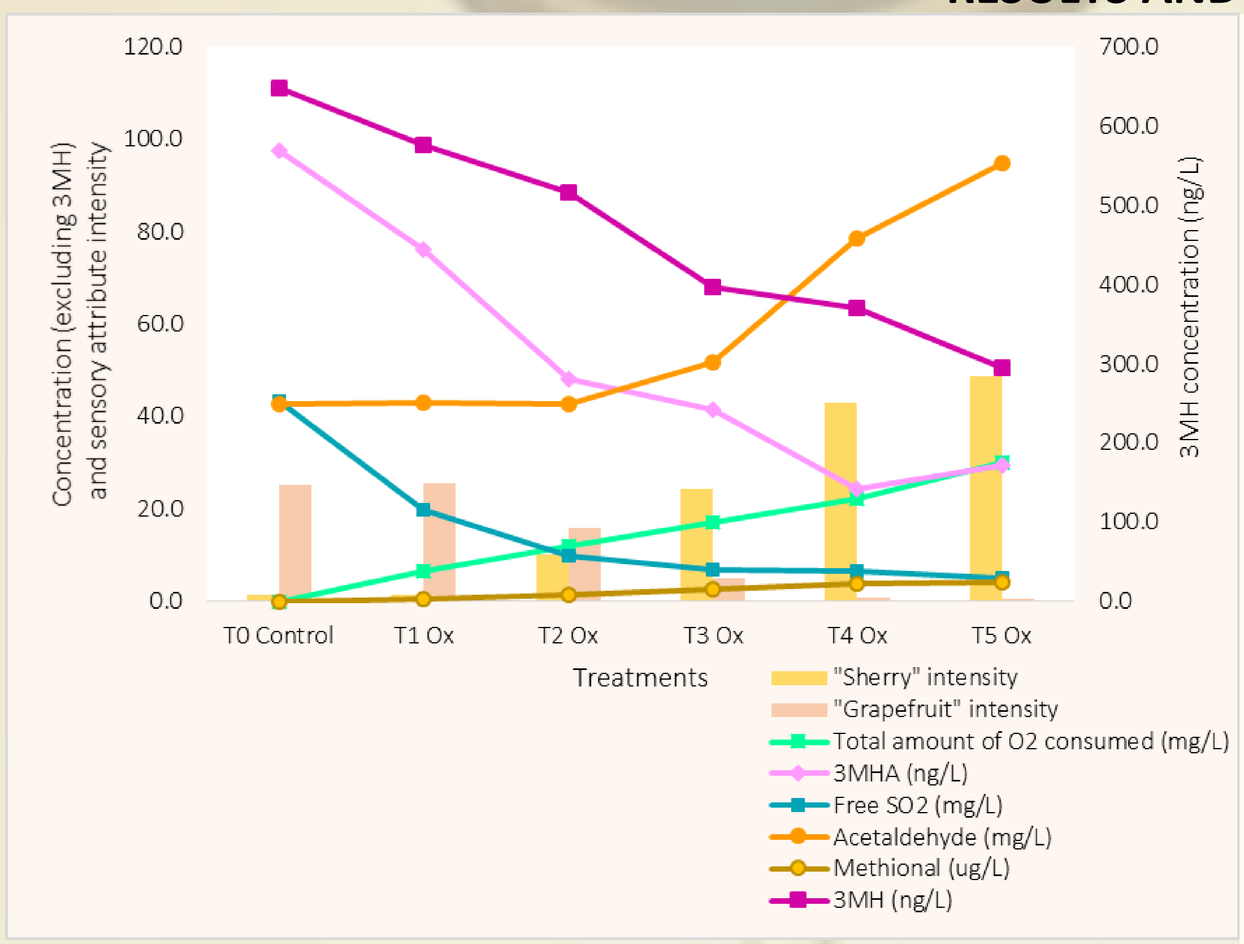

Figure 2. Evolution of various compounds during oxidative storage of a Sauvignon blanc wine. Sensory attribute intensities of some attributes are also included as bars. Values are means of triplicate analysis

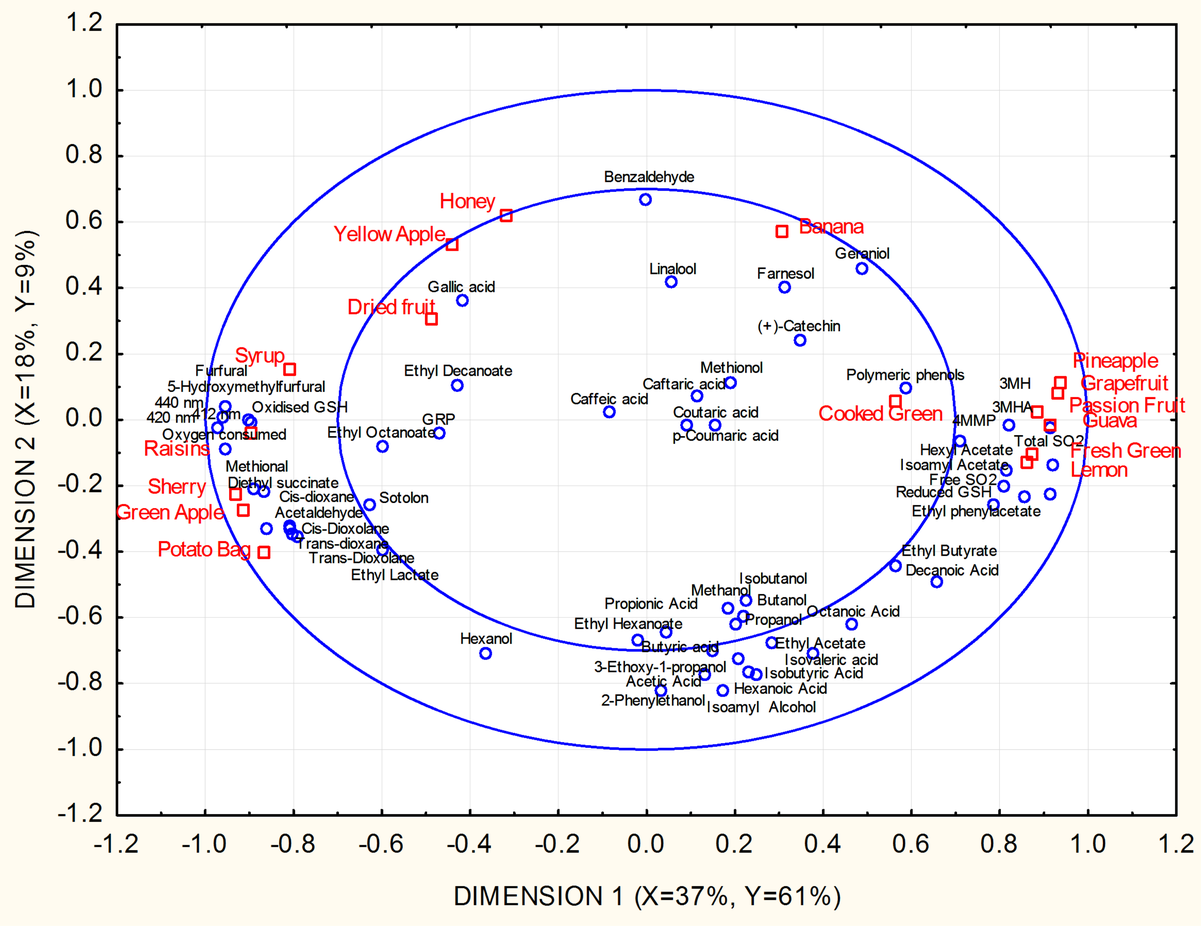

Figure 3. PLS plot of component 1 and component 2 containing chemical information in the X-space and the sensory descriptive data in the Y-space

- Thiol concentration still above perception threshold (T3-T5 Ox, figure 2)
- Masking and suppressing effects of newly formed compounds could cause decrease in "grapefruit"
- Decrease in fruity character due to
  - Oxidative loss
  - Sensory interactive effects (6)

- Sensory attributes corresponded well with chemical analysis (figure 3)
- Control samples (T1 to T5 Control) no drastic differences during sensory evaluation (not shown)
- "Cooked green" increased from T0 Control to T5 Control – none in Ox
  - Development of 'reductive' odours due to low oxygen content (5)

Overall sensory results (results not shown)

- T1 Ox fresher and fruitier than T1 Control
- T1 Ox similar chemical composition than Control samples
- Addition of moderate amounts of O_2 enhanced the aromatic profile of the wine
- Oxygen inhibits the formation of 'reductive' off-odours
- Ability of 'reductive' compounds to mask/suppress fruity aroma?

CONCLUSIONS

This is the first study where a comprehensive overview of both chemical (aromatic and non-aromatic) as well as sensory data has been obtained during repetitive oxidation of the wines. This provides insight into the advantages as well as the disadvantages of various levels of oxygen exposure as well as the capacity of a wine to consume oxygen.

- Determining the complete chemical content of the wine is a daunting task
  - Will most certainly not include all the compounds at this stage
- Combining the chemical with the sensory analysis confirmed the difficulty in matching the two data sets precisely, as predictions according to chemical data alone did not always coincide with the sensory profiling of the wine.
  - The presence of compounds not measured in the study could play an important role in this observation.
- Recent publications clearly shows the complexity of the interactions that occurs between various chemical compounds in a wine medium.
  - Masking, suppressing and enhancing effects complicate the interpretation of a wine's sensory composition when observing from a chemical viewpoint alone
  - In a complex medium such as wine, these effects should always be considered.

- Analytical measurement of aroma compounds to predict the sensory composition of a wine
- approximate tool
- complex interactions
- even a comprehensive survey of chemical compounds would not necessarily include all compounds present.

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