WHICH HEAT TEST REALLY REPRESENTS THE HAZE RISK OF A WHITE SAUVIGNON WINE ?

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Introduction

Cloudiness in a bottle of white wine is unquestionably perceived as a defect and for the overall image a consumer will have of a wine. It is therefore essential to ensure the stability of the clarity of a wine after bottling, whatever the conditions encountered during transport and throughout the storage of the wine, including during heatwaves. To decide which oenological treatment to use, the Wine Haze Risk (WHR) is systematically estimated by a heat test in which the wine is heated to 80°C for 30 minutes to 2 hours. These conditions are far removed from the temperatures to which a wine may be subjected, even in heatwave conditions. This significant difference in temperature between the heat tests carried out in the laboratory and the reality that a white wine may encounter has led us to reconsider the relevance or accuracy of this 80°C test, which is used internationally. This approach is also in line with the numerous observations that wine producers and oenology laboratories have been reporting to us for years and which can be summarised as follows : the 80°C test overestimates the RCC- the 80°C test sometimes wines that, according to the experience of winemakers, never show protein breakage after bottling.

For this, we have compared tests gives haze for where the wines are subjected to heat waves temperatures (38, 42 and 46°C), the duration of which can be counted in days, with heat tests at 50°C and 80°C which take place over a few tens of minutes. The aim of this study is twofold: 1) **to determine the overestimation of the WHR with laboratory tests**, and 2) to see **which test is more correlated with reality**.

Experimental protocol

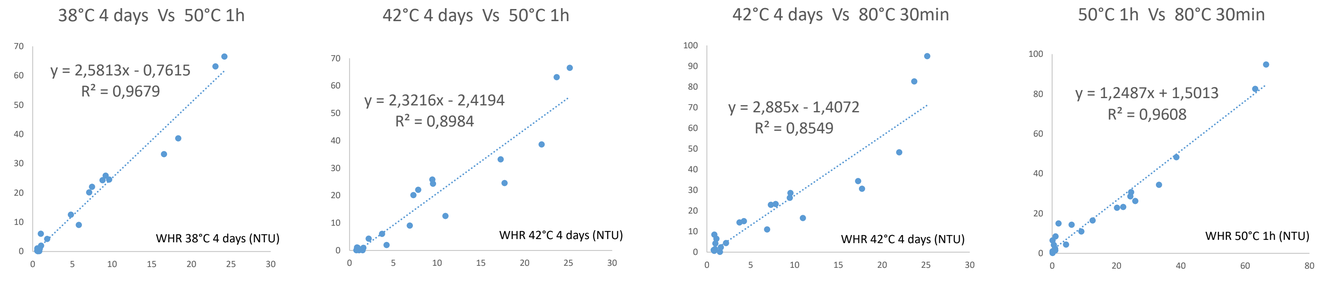
The white wines studied are made with Sauvignon grapes from the Loire Valley. They concern the 2018 and 2019 vintages. All the wines (22 for 2018 and 18 for 2019; i.e a total of 40 wines) are filtered on 0.45µm cutting membranes before the 20 heat tests. Three conditions were carried out for each wine : **Heatings at 80°C** for 30, 45, 60 min, **Heatings at 50°C** for 30, 45, 60 and 90 minutes, **Heat wave conditions** : 4 days at 38°C, 4 days at 42°C and 4 days at 46°C.

For all these tests, the wines were placed in glass microbiology tubes with stoppers equipped with a seal to prevent any loss of liquid (15mL of wine/tube). The 20 heating conditions were analysed in triplicate for all wines. For the heat conditions, the wines were placed in a culture chamber. For tests at 50 and 80°C, the tubes were immersed in the thermostatic bath,

At the end of the heat treatment, the wines are left at laboratory temperature until the following day. Turbidities are measured with a portable HANNA turbidimeter.

The Pearson's correlation test was performed by using Microsoft Office Excel 2016 software. The correlation coefficients (r values, $p < 0.05$) were obtained to reveal the relationships between the different heat tests, compared 2 by 2. The coefficients giving significant positive correlations were marked in pale green ($r > 0.95$). The coefficients showing a high positive correlations are presented in dark green ($0.95 > r > 0.8$).

SAUVIGNON 2018



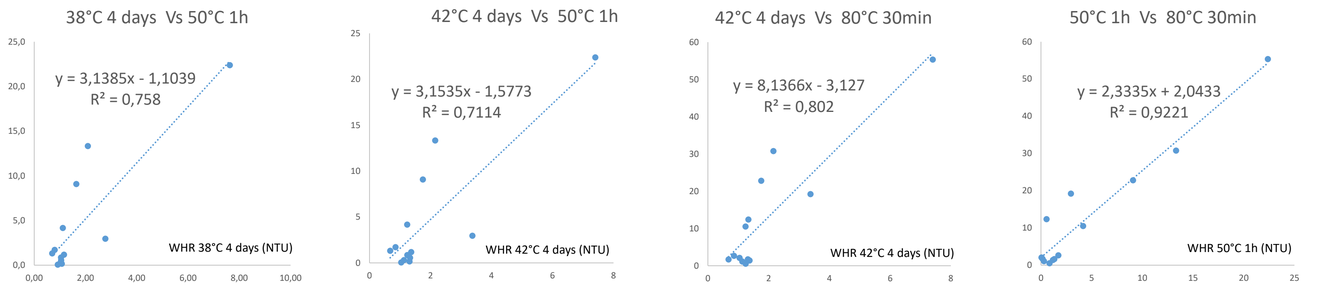
The turbidities observed after heating for 4 days at 38°C or 4 days at 42°C are closely correlated with the turbidities measured in the wines after heating for 1 hour at 50°C, with determination coefficients R^2 of 0.9679 and 0.8984 respectively. The slopes of these two lines also indicate that the heat test 1hr at 50°C gives turbidities 2.58 and 2.32 times higher than the values observed with the heatwave tests, but lower than the values noted after heating at 80°C. Finally, the turbidities after heating to 50°C or 80°C are very closely correlated ($R^2 = 0.9602$).

Pearson test correlation coefficients (r) among the 2018 Sauvignon blanc wines ($p < 0.05$).

Variables	38°C 4 days	42°C 4 days	30min 50°C	45min 50°C	60min 50°C	90min 50°C	30min 80°C	45min 80°C	60min 80°C
38°C 4 days	1								
42°C 4 days	0,966	1							
30min 50°C	0,983	0,949	1						
45min 50°C	0,984	0,949	1,000	1					
60min 50°C	0,984	0,948	1,000	1,000	1				
90min 50°C	0,986	0,959	0,998	0,999	0,999	1			
30min 80°C	0,953	0,925	0,980	0,980	0,980	0,978	1		
45min 80°C	0,941	0,914	0,966	0,967	0,967	0,966	0,995	1	
60min 80°C	0,921	0,897	0,946	0,947	0,948	0,947	0,981	0,995	1

All the r values show significant positive correlations between the 50°C heat tests and the heatwave tests, especially at 38°C ($0.983 < r < 0.986$). Concerning the 80°C tests, the correlations with the 38°C heat test remain high for heating times of 30-45 min. Nevertheless, the comparison with the 42°C test gives worse correlations ($0.897 < r < 0.925$) than those noted with the 50°C heat tests ($0.948 < r < 0.949$).

SAUVIGNON 2019



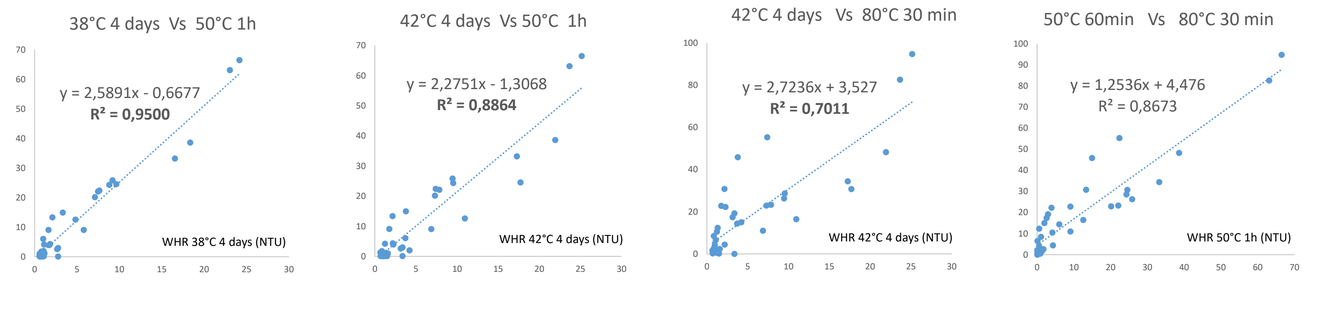
The turbidities observed after heating for 4 days at 38°C or 4 days at 42°C are not so closely correlated with the turbidities measured in the wines after heating for 1 hour at 50°C. The determination coefficients R^2 reached only 0.9758 and 0.7114 respectively. The slopes of these two lines also indicate that the heat test 1hr at 50°C gives turbidities 3.14 and 3.15 times higher than the values observed with the heatwave tests, but lower than the values noted after heating at 80°C that overestimates 8.14 times the haze risk. The turbidities after heating to 50°C or 80°C are closely correlated ($R^2 = 0.9221$).

Pearson test correlation coefficients (r) among the 2019 Sauvignon blanc wines ($p < 0.05$).

Variables	38°C 4 days	42°C 4 days	46°C 4 days	30min 50°C	45min 50°C	60min 50°C	90min 50°C	20min 80°C	30min 80°C	45min 80°C	60min 80°C
38°C 4 days	1										
42°C 4 days	0,990	1									
46°C 4 days	0,929	0,964	1								
30min 50°C	0,816	0,777	0,688	1							
45min 50°C	0,788	0,751	0,673	0,997	1						
60min 50°C	0,810	0,767	0,680	0,997	0,997	1					
90min 50°C	0,817	0,778	0,701	0,997	0,996	0,997	1				
20min 80°C	0,833	0,812	0,763	0,980	0,981	0,976	0,982	1			
30min 80°C	0,815	0,807	0,787	0,949	0,954	0,945	0,956	0,992	1		
45min 80°C	0,793	0,797	0,802	0,894	0,900	0,887	0,903	0,963	0,985	1	
60min 80°C	0,785	0,788	0,791	0,902	0,909	0,896	0,911	0,968	0,989	0,999	1

For the correlations between the 50°C tests and the heat wave tests (38°C and 42°C), the r values were between 0.75 and 0.82. For the correlations with the 80°C tests, the r values were slightly higher ($0.79 < r < 0.83$). However, none of the r coefficients reached a significant value as for the 2018 vintage. The number of wines studied was also lower.

SAUVIGNON 2018 + 2019



These 4 graphs take into consideration all wines of 2018 and 2019. The turbidities observed after heating for 4 days at 38°C or 4 days at 42°C are closely correlated with the turbidities measured in the wines after heating for 1 hour at 50°C, with determination coefficients R^2 of 0.9500 and 0.8864 respectively. The slopes of these two lines also indicate that the heat test 1hr at 50°C gives turbidities 2.59 and 2.27 times higher than the values observed with the heatwave tests. Finally, The comparison between the heat test at 80°C and the "heatwave" test at 42°C showed a more pronounced dispersion of the points around the line, with a R^2 only reaching 0.7011

Pearson test correlation coefficients (r) among the 2018 Sauvignon blanc wines ($p < 0.05$).

Variables	38°C 4 days	42°C 4 days	30min 50°C	45min 50°C	60min 50°C	30min 80°C	45min 80°C	60min 80°C
38°C 4 days	1							
42°C 4 days	0,971	1						
30min 50°C	0,977	0,947	1					
45min 50°C	0,976	0,944	1,000	1				
60min 50°C	0,975	0,941	0,999	1,000	1			
30min 80°C	0,874	0,837	0,924	0,927	0,931	1		
45min 80°C	0,836	0,802	0,884	0,888	0,892	0,990	1	
60min 80°C	0,820	0,790	0,870	0,875	0,879	0,980	0,996	1

Taking the 2018 and 2019 WHRs together, we see that the r values show **significant positive correlations** between the 50°C heat tests and the heatwave tests at 38°C ($0.975 < r < 0.977$). Concerning the 80°C tests, the correlations with the 38°C heat test remain high ($0.820 < r < 0.874$) but not significant. Moreover, the comparison with the 42°C test gave much worse correlations ($0.790 < r < 0.837$) than those noted with the 50°C heat tests ($0.941 < r < 0.947$).

Conclusions

This study strongly evidenced the **possibility to use the heat test corresponding to 1 hour at 50°C as an efficient test to estimate the WHR of Sauvignon wines, while maintaining a safety margin with respect to the haze that may occur in a bottle during a heatwave**.

These comparisons between laboratory heat tests and heat wave realities showed that **a realistic estimation of the WHR allows the choice of an adapted and realistic oenological treatment**. For many wines, this clearly means a reduction or even elimination of the amount of bentonite used for colloidal stabilisation. It is also the possibility to reconsider or develop technical alternatives that are considered insufficient if we refer to the 80°C test but quite efficient if we refer to a 50°C test.

Further investigations are already planned for the coming vintage 2021 to study wines produced with different grape varieties, different levels of maturity and produced in different European areas/regions.