

# Olfactometric and sensory study of red wines subjected to ultrasound or microwaves during their elaboration

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## Introduction

There are different oenological processes in the production of red wine that have a crucial impact on its quality and cost. Some of them are the pre-fermentative maceration phase, or the ageing in wood process. Pre-fermentative maceration is one of the most important steps in red winemaking<sup>1-2</sup>. Together with this one, the ageing in wood is another extractive process that models the specific aromas from grape and those from the fermentative phase and harmonizes it with the aromas extracted from the wood itself<sup>3</sup>. Both phases result in very long times required to obtain the final product. It could be interesting to reduce this time without affecting the quality of the resultant wine. For this purpose, ultrasound (US) and microwaves (MW) are some of the techniques that are being. In this work, the feasibility of the use of US and MW for the production of red wines while maintaining or even improving the organoleptic characteristics of the final product has been considered. For this purpose, the study on the wines' aromatic profile by means of gas chromatography coupled with olfactometric detection (GC-O) as well as on the sensory characteristics of the wines obtained have been carried out.

## Materials and methods

**Grapes:** tempranillo, vintage 2008

**Vinification:**

- ✓ **Control vinification:** (C)
- ✓ **Ultrasound vinification:** (U) *Img. 1.*
- ✓ **Microwaves vinification:** (M) *Img. 2.*

**Ageing:** Medium toasted chips (5 g/L)  
Spanish oak (*Quercus Pyrenaica*; S)  
French oak (*Quercus robur*; F)  
*Img. 3.*

- ✓ **Control ageing:** (C.S) and (C.F)
- ✓ **Ultrasound ageing:** (U.S) and (U.F)
- ✓ **Microwaves ageing:** (M.S) and (M.F)

**Analysis: GC-O-MS**  
*Img. 4.*

**Sensory analysis**  
*Img. 5 and Img. 6.*



*Img. 1.* Ultrasound vinification system



*Img. 2.* Microwaves instrument



*Img. 3.* Wood chips



*Img. 4.* GC-O-MS

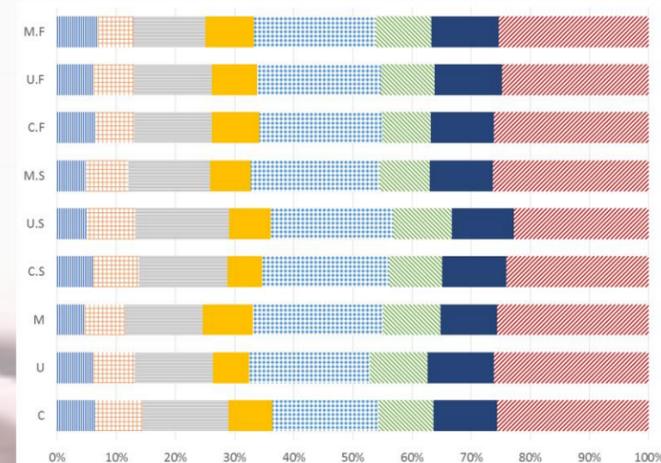


*Img. 5.* Triangular tests

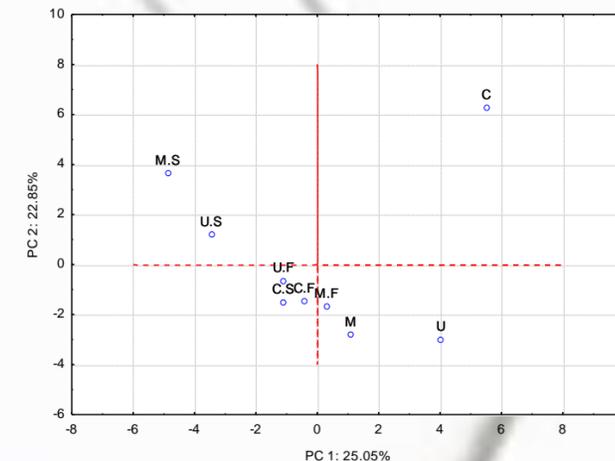


*Img. 6.* Descriptive analysis

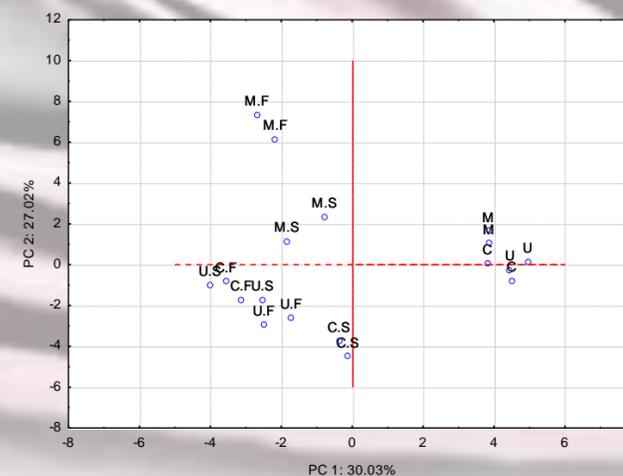
## Results



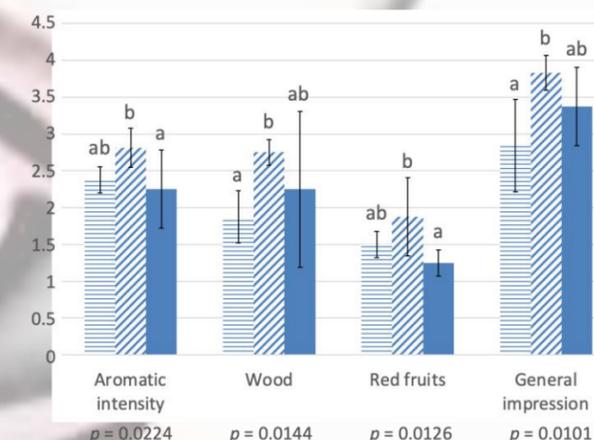
**Fig. 1.** Olfactometric contribution (%) from each family of aromas to the total modified frequency of the analyzed samples. Sweet, Fruity, Flower, Green, Smoke, Spicy, Chemical, Unpleasant.



**Fig. 2.** Principal Component Analysis (PCA) on olfactometric data



**Fig. 3.** Principal Component Analysis (PCA) on mass spectrometry data



**Fig. 4.** Sensory analysis. Results of the descriptive tests of the samples and ANOVA according to the accelerating treatment employed: Control, Ultrasound, Microwaves; a,b,c, different letters indicate significant differences according to Tukey's test ( $p < 0.05$ ).

## Conclusions

The volatile content of red wines, as expected, was influenced by the application of extractive agents both the pre-fermentative maceration and ageing (Fig. 1). No evidence was found that microwave or ultrasound treatments during the pre-fermentative maceration would modify young wines' sensory or olfactometric profile (Fig. 2). The application of U and M energies during the ageing process showed positive changes at a sensory level that were detected in the olfactometric study and also by means of mass spectrometry (Fig. 3). U during the ageing resulted in a higher contribution of red fruits, aromatic intensity and wood than those from M (Fig. 4).

In relation to oak chips, Spanish oak provided more volatile compounds than French one. Thus, from a sensory point of view, Spanish oak exhibited greater aromatic intensity and higher values of the wood descriptor.

## References

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