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Innovative oenological strategies for enhancing the varietal expression of the grapes

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Introduction

The PhD project focuses on two main studies, the first one is related to grape withering and the second one concerns the use of oenological tannins during and after winemaking to preserve important secondary metabolites for wine quality. Grape withering causes water loss with a consequent concentration of sugars and modification of phenolic composition. Postharvest withering under controlled conditions with low temperatures allows better preservation of secondary metabolites (Mencarelli & Tonutti, 2013), but relative humidity and airflow are also important parameters in regulating the dehydration rate. Shorter dehydration time could also be useful for wineries to save energy, time and storage space. In addition, there is a lower likelihood of developing fungal infections (Aim A).

Tannins are phenolic compounds with multiple properties and they have been particularly used in recent years as antioxidants to reduce the dosage of sulfur dioxide, which is responsible for allergies and intolerances. Exogenous tannins added during winemaking could also interact with volatile organic compounds (VOCs). The result could be aroma retention or a salting-out effect, depending on the hydrophobicity, π-π staking interactions and concentration of the molecules, which would affect the aroma preservation during winemaking, after bottling and also the overall aroma perception during the tasting phase (Aim B).

In the last case, tannins interact with salivary proteins in the mouth to form aggregates, which may encapsulate aroma compounds, influencing their volatility and making them less available for detection by the olfactory system (Lyu *et al.*, 2021, Muñoz-González *et al*., 2014) (Aim C).

Keywords

Grape withering
Low relative humidity
Low temperature
Aroma
Tannins
Salivary protein
HS-SPME-GC/MS

Aims

A) To test a new grape withering system that uses low relative humidity (LRH) to shorten the dehydration time required when using low temperatures (LT) and, at the same time, to achieve better preservation of grape polyphenols and higher extractability during winemaking.

Nebbiolo grapes withering

LT & LRH: 15 °C + 40% RH
LT: 10 °C
MT: 25 °C

Analysis of fresh grapes and at 25% berry weight loss:
- standard parameters, berry skin hardness, phenolic compounds;
- extractability studies of phenolic compounds: simulated maceration of skins and seeds.

B) To understand these interactions from a chemical and sensory perspective to better preserve wine aroma by using oenological tannins from different origins (grape skin and seeds, quebracho, acacia, ellagic and gallic).

White grape must

Bottled white wine

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Oenological tannins

Wine standard parameters

VOCs profile by HS-SPME-GC/MS

Sensory analysis

C) To study the interactions between saliva, oenological tannins and VOCs using a model wine solution by analyzing VOCs in gas/liquid phases.

Saliva

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VOCs

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Oenological tannins

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Possible interactions

VOCs analysis by HS-SPME-GC/MS

PhD thesis objectives and milestones

Activity		Months 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
A1)	***Red winegrape withering process***	■	■	■	■	■	■	■	■																
	1) Withering process	■	■	■																					
	2) Berry skin hardness and standard parameters determination	■	■	■																					
	3) Simulated maceration and extraction kinetics for phenolic compounds	■	■	■																					
	4) Determination of potential phenolics			■	■	■	■																		
	5) Data treatment	■	■	■	■	■	■	■	■																
A2)	***Effect of oenological tannins on wine aroma***					■	■	■	■	■				■	■	■	■	■	■	■	■	■	■	■	■
	1) Winemaking of white grapes with/without addition of exogenous tannins													■	■										
	2) Addition of tannins at bottling						■																		
	3) Determination of color, antioxidant potential and standard parameters						■	■								■	■				■	■			
	4) VOCs determination							■	■	■							■	■	■				■	■	■
	5)Sensory analysis							■	■	■							■	■	■				■	■	■
	6) Data treatment							■	■	■	■					■	■	■	■	■	■	■	■	■	■
A3)	***Interactions tannins/VOCs/saliva***									■	■	■	■	■											
	1) HS-SPME-GC/MS analysis for interaction VOCs/saliva									■	■	■													
	2) HS-SPME-GC/MS analysis for interaction tannins/VOCs/saliva											■	■	■											
	3) Data treatment									■	■	■	■	■	■	■									
A4)	***Thesis and Paper Preparation***	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

References

Lyu J, Chen S, Xu Y, Li J, Nie Y, Tang K (2021) Influence of tannins, human saliva, and the interaction between them on volatility of aroma compounds in a model wine. *J Food Sci* **86**:4466–4478.

Mencarelli F, Tonutti P (2013) Sweet, reinforced and fortified wines: Grape biochemistry, technology and vinification. John Wiley & Sons, pp. 105-115.

Muñoz-González C, Feron G, Guichard E, Rodríguez-Bencomo JJ, Martín-Álvarez Pj, Moreno-Arribas MV, Pozo-Bayón MA (2014) Understanding the Role of Saliva in Aroma Release from Wine by Using Static and Dynamic Headspace Conditions*. J Agric Food Chem*, **62.33**: 8274-8288.