Influence of non-allergenic fining agents on white wine phenolic and volatile composition

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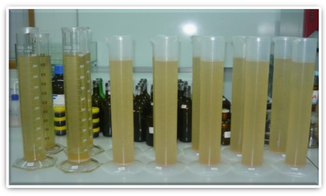
INTRODUCTION

White wine fining is an important operation to stabilize wine colour by removing phenolic compounds, in order to control wine browning capacity. However, the choice of oenological products is increasingly important because consumers are concerned regarding food safety. Due to allergic reaction problems by some consumers, together with the restriction of European legislation [1] and the specific legislation of certain countries, non-allergenic fining agents are being developed in detriment to traditional fining agents used in the wine industry. However, the impact of non-allergenic fining agents on wine phenolic composition, volatile composition and sensory profile is not well known. Therefore, the purpose of this work was to evaluate the impact, on a white wine from the Douro Demarcated Region, of six fining agents regarding their phenolic, volatile composition and sensory profile.

MATERIAL AND METHODS

Experimental design – Experiments involved the addition of potassium caseinate (PC), PVPP, pea protein (PP), yeast cell walls (YCW), association of vegetable protein with yeast cell walls (VP/YCW) and association of PVPP with vegetable protein (PVPP/VP). Untreated wine was used as control (C). All experiments were done in duplicate.



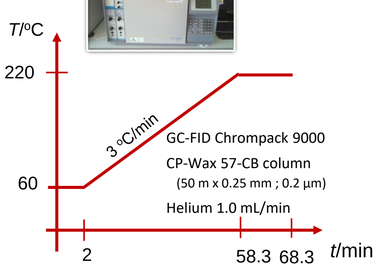
Wine characteristics – Young white wine from the Douro Demarcated Region produced with *Gouveio Real*, *Rabigato*, *Viosinho* and *Malvasia Fina* grape-varieties, was used. The wine main characteristics were as follows: alcohol 13.3 % (v/v); pH 3.31; titratable acidity 6.1 g/L (tartaric acid); volatile acidity 0.31 g/L (acetic acid); free and total sulphur dioxide 33 mg/L and 70 mg/L, respectively.

Sensory analysis - A trained sensory panel performed the sensory analysis. The attributes were quantified using a five-point intensity scale [2] according to standardized procedures [3, 4].

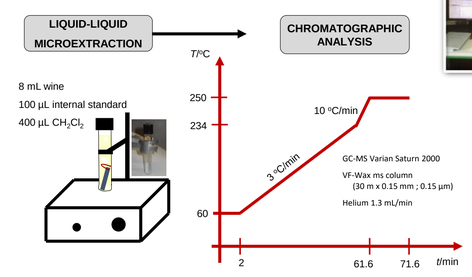
Phenolic acids and flavonoid profile – Determined according to Guise et al. [5].

Colour – Determined according to OIV [6].

Major volatile compounds
Sample: 5 mL wine + 100 µL 4-nonanol (IS) 3.54 g/L
Injection (250 ºC) 1 µL; split ratio = 15 mL/min



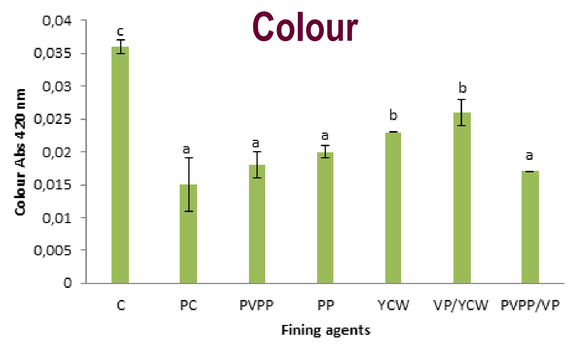
Minor volatile compounds
Sample: 8 mL wine + 100 µL 4-nonanol (IS) 35.4 mg/L
Injection (250 ºC): 1 µL; split ratio = 30 mL/min (splitless = 30 s)



RESULTS AND DISCUSSION

% (area) of phenolic acids and flavonoid compounds in white wines

Fining agent	Gallic acid	Catechin	*trans*-caftaric acid	2-S-glutathionylcaftaric acid	Coutaric isomeric acid	Coutaric acid	Caffeic acid	4--hydroxycoumaric acid	Ferulic acid	Ethyl caffeic acid	Ethyl coumaric acid
C	66.9±9.2^{a}	33.1±9.2^{a}	42.1±7.1^{a}	0.1±0.2^{a}	0.7±0.1^{a}	12.0±1.6^{a}	20.5±2.4^{a}	7.4±1.0^{a}	1.1±0.^{a}	12.4±1.7^{a}	3.8±0.5^{a}
PC	66.6±2.7^{a}	33.4±2.7^{a}	42.4±8.4^{a}	0.2±0.3^{a}	0.7±0.1^{a}	12.0±1.6^{a}	20.2±3.2^{a}	7.3±1.2^{a}	1.1±0.1^{a}	12.3±2.0^{a}	3.9±0.6^{a}
PVPP	70.4±7.1^{a}	29.6±7.1^{a}	37.3±7.3^{a}	0.1±0.1^{a}	0.7±0.1^{a}	12.8±1.9^{a}	21.4±2.1^{a}	8.1±0.1^{a}	1.2±0.1^{b}	14.0±1.7^{a}	4.4±0.6^{a}
PP	69.4±1.1^{a}	30.6±1.1^{a}	40.1±8.2^{a}	0.3±0.4^{a}	0.7±0.2^{a}	11.3±1.6^{a}	21.8±2.9^{a}	7.7±1.0^{a}	1.2±0.2^{b}	13.1±1.7^{a}	4.00±0.5^{a}
YCW	71.7±0.1^{a}	28.3±0.1^{a}	33.8±0.9^{a}	0.2±0.2^{a}	0.7±0.0^{a}	13.0±0.2^{a}	24.0±0.3^{a}	8.4±0.1^{a}	1.3±0.0^{b}	14.4±0.2^{a}	4.3±0.0^{a}
VP/YCW	72.1±2.1^{a}	28.0±2.1^{a}	31.6±0.6^{a}	0.1±0.1^{a}	0.7±0.0^{a}	12.5±0.3^{a}	25.1±0.3^{a}	8.9±0.1^{a}	1.4±0.1^{b}	15.2±0.2^{a}	4.5±0.1^{a}
PVPP/VP	70.3±3.9^{a}	29.8±3.9^{a}	39.8±8.8^{a}	0.0±0.0^{a}	0.7±0.1^{a}	11.6±1.7^{a}	21.4±3.1^{a}	7.9±1.2^{a}	1.1±0.2^{a}	13.4±2.0^{a}	4.1±0.7^{a}

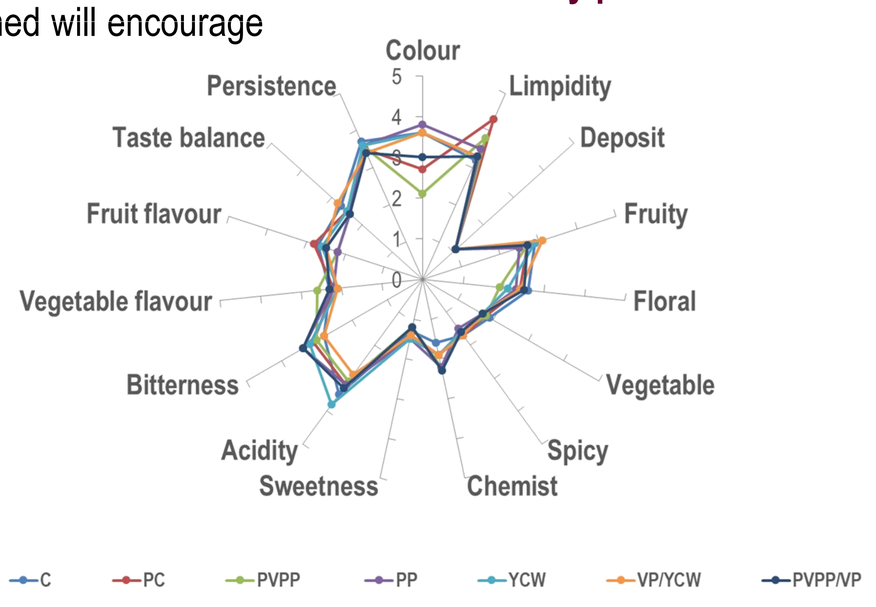


The concentration of esters compared to the control wine was lower in treated wines. 2-phenylethanol decreases in the wine treated with yeast cell walls. However, individually, the higher alcohols do not give pleasant wine aromas, with the exception of 2-phenylethanol, but together they can contribute positively to the wine aroma. All non-allergenic fining agents tested decreased the white wine colour. Sensory analysis indicated that only the wines treated with potassium caseinate and PVPP showed a significant decrease in colour attribute. The more scored wine for the fruity attribute was the wine treated with pea protein and the more scored wine for the floral attribute was the wine treated with yeast cell walls. Thus, the results obtained will encourage the implementation of this type of fining agents at industrial scale.

Concentration (mg/L) of major volatile compounds in white wines

Fining agent	Acetaldehyde	Ethyl acetate	Methanol	Higher alcohols				
				1-propanol	2-methy--1-propanol	2-methy-1--butanol	3-methy-1--butanol	2--phenylethanol
C	11.3±8.5^{a}	59.9±17.0^{a}	62.9±17.3^{a,b}	50.4±4.2^{a}	22.6±2.7^{a}	26.2±1.7^{a}	174.6±7.9^{a}	39.0±18.0^{a}
PC	15.3± 4.4^{a,b}	70.2± 11.8^{a}	52.8± 10.3^{b}	52.5±2.1^{a}	24.9±0.7^{a}	29.6±0.3^{a}	194.1±2.5^{a}	34.6±2.3^{a}
PVPP	13.4±0.1^{a,b}	63.1±1.7^{a}	39.0±3.0^{a,b}	46.8±1.5^{a}	22.2±0.5^{a}	26.9±0.9^{a}	176.4±7.7^{a}	36.5±4.3^{a}
PP	12.4±3.3^{a,b}	70.2±2.7^{a}	31.6±15.8^{a,b}	51.2±0.2^{a}	23.8±0.5^{a}	28.3±1.0^{a}	185.5±5.7^{a}	28.7±5.7^{a}
YCW	11.5±2.3^{a,b}	59.8±3.2^{a}	21.7±1.7^{a}	48.8±0.2^{a}	19.9±4.6^{a}	27.3±1.1^{a}	183.0±0.6^{a}	19.2±9.1^{a}
VP/YCW	9.8±0.4^{b}	60.7±3.1^{a}	44.9±3.2^{a,b}	50.5±1.9^{a}	22.4±0.8^{a}	26.8±0.2^{a}	179.6±2.6^{a}	38.5±9.6^{a}
PVPP/VP	10.7±1.7^{b}	61.3±6.2^{a}	40.7±1.2^{a,b}	47.6±0.7^{a}	22.2±0.3^{a}	26.7±0.2^{a}	175.6±1.8^{a}	33.9±0.9^{a}

Wine sensory profile



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