Effect of different fining agents and additives in white wine protein stability

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Introduction

Wine protein fractions and their concentration in wine depends on some factors such as grape variety, climate conditions, soil type, growth environments in the vineyard, maturity and winemaking process. Bentonite fining is a commonly used process in wine industry to prevent formation of protein haze in white wine, although they could remove other chemical species. Therefore, addition of bentonite could have a sensorial impact on aroma and flavour. Thus, right dosage of bentonite must be previously determined by stability tests. Consequently, alternative techniques for bentonite fining have been studied such as ultrafiltration, addition of proteolytic enzymes, flash pasteurization, alternative adsorbents, zirconium oxide treatment and the use of some mannoproteins.

Objective

The main purpose of this study was to evaluate the effect of different types of bentonites and mannoproteins on white wine protein stability, to get new approaches to stabilize them.

Material and Methods

A white wine from Douro Valley 2011 vintage was used in these trials; their main characteristics were as follows: alcohol content (% v/v) 14.2, specific gravity (20ºC) (g/mL) 0.9890, titratable acidity (g/L tartaric acid) 5.5, pH 3.29, volatile acidity (g/L acetic acid) 0.31, protein stability heat test 7.09 NTU.

Five different types of bentonites (B1-activated sodium and calcium, B2-activated calcium, B3-natural calcium, B4-sodium and calcium activated, and B5-natural sodium) and eleven types of mannoproteins (M1 - M11) with different molecular weight and extraction processes were used. Medium concentration of bentonites and highest concentration of mannoproteins were prepared according to the manufacture´s specifications. Experiments were conducted in 375 mL flasks at 20ºC for 7 days. All experiments were performed in duplicate.

Wine analysis: Alcohol, specific gravity, pH, titratable acidity and volatile acidity analysis were performed using a FTIR Baccus. Heat test and tricloroacetic acid test were performed to access protein stability. Chromatic characteristics and colour were carried out according to OIV [1]. Flavonoid phenols and non-flavonoids were determined according Kramling and Singleton [2]. All analyses were performed in duplicate.

Sensory analysis: Fifteen attributes were selected: visual (limpidity, colour), aroma (aroma intensity, fruity, floral, vegetable, oxidised, chemist) and taste (sweetness, acidity, bitterness, flavour intensity, body, balance, persistence). The attributes were quantified using a ten-point intensity scale. This analyses were performed by a trained panel.

Statistical analysis: ANOVA of both physicochemical and sensory data and PCA for sensory data, using Statistica 7 software (Statsoft, OK, USA).

Results and discussion

All bentonites stabilized the wine according to the heat test, with an exception in the TCA test for bentonite B1.

In relation to mannoproteins it was observed high thermal protein stability since 9 onto 11 studied mannoproteins stabilized the wine by the heat test (Table 1).

In opposite, the results of TCA test in all the trials were unstable with mannoproteins.

Table 1 Protein stability by heat test and tricloroacetic acid test (TCA).

Bentonites			Mannoproteins		
	Heat test	TCA test		Heat test	TCA test
Control	+	+	Control	+	+
B1	-	+	M1	-	+
B2	-	-	M2	-	+
B3	-	-	M3	-	+
B4	-	-	M4	-	+
B5	-	-	M5	+	+
			M6	-	+
			M7	-	+
			M8	-	+
			M9	+	+
			M10	-	+
			M11	-	+

Stability tests: unstable (+), stable (-).

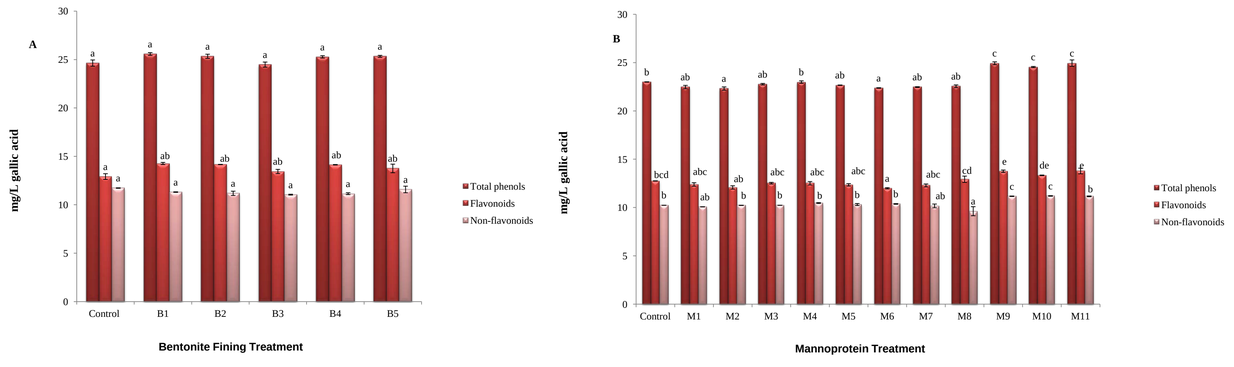

Figure 1 Flavonoids, non-flavonoids, total phenols of both unfined and fined white wine with bentonite (A) and mannoprotein (B).

Bentonite fining had no significant effect on total phenols, flavonoids and non-flavonoids compounds, however some mannoproteins decreased the concentration of total phenols, with exception of M9, M10 and M11 (Fig.1).

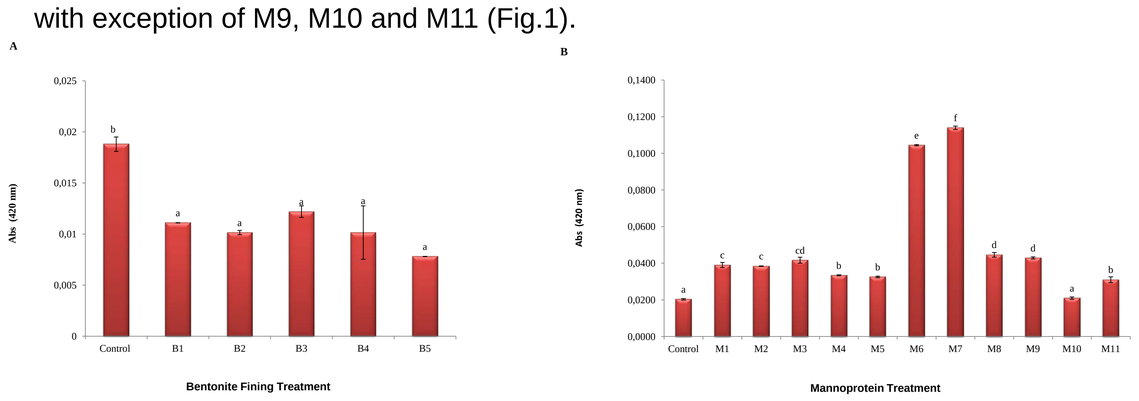

Figure 2 Colour of both unfined and fined white wine with bentonite (A) and mannoprotein (B).

All bentonites decreased wine colour (Fig. 2 A), in opposition mannoproteins generally increased wine colour, being the highest values for mannoproteins M6 and M7 (Fig. 2 B).

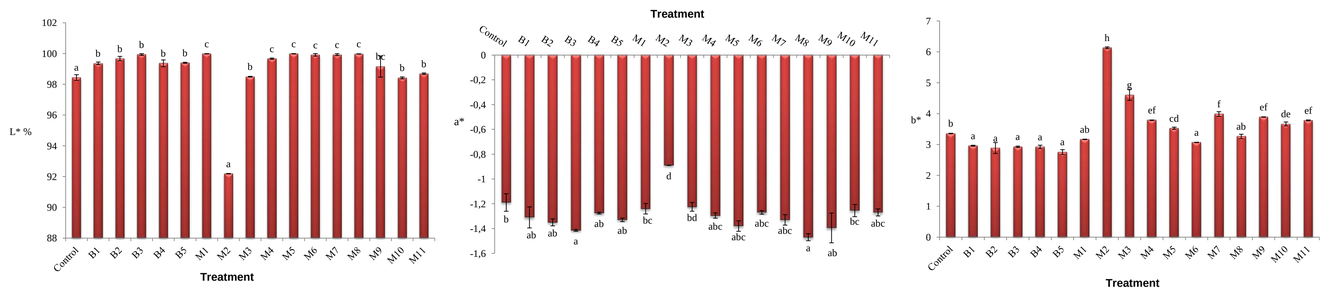

Figure 3 Chromatic characteristics (L* %, a*, b*) of both unfined and fined white wine with bentonite and mannoproteins.

Lightness was improved in all wines with exception of the wine treated with mannoproteins M2. The b* value (yellowness) decreased with all bentonites and with some mannoproteins (M1, M6, M8).

No significant differences among the wines were detected by sensory analyse (Fig. 4).

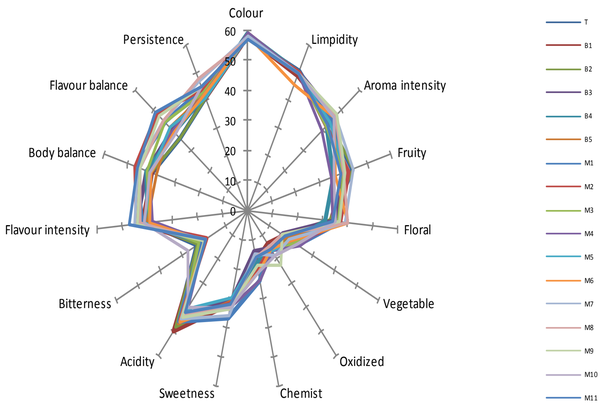

Figure 4 Sensory profile of white wine obtained by the mean of the scores given by the panelists.

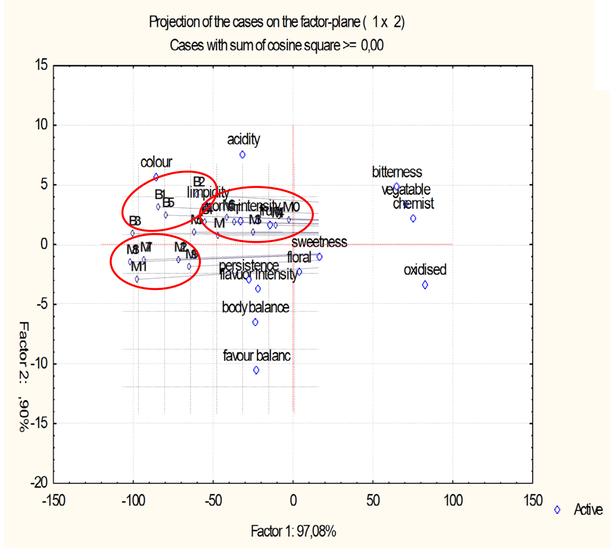

Figure 5 PCA analysis projection of white wine samples evaluated sensorially.

Principal Component Analysis (PCA) revealed three groups: group I - B1, B2, B3, B5, M5, M6; group II - M2, M7, M8, M9, M11 and group III - M1, M3, M4, M10, B4 (Fig. 5). The wines in group II were the highest scored and the wines from group I and III the lowest scored (Fig. 5).

Conclusions

- Results of this work confirm the relative good efficiency of bentonites to remove unstable white wine proteins, and interesting results were obtained with mannoproteins, because high thermal stability of white wine proteins was achieved.
- Mannoproteins seems to improved sensorial characteristics of wine.
- Mannoproteins could be an alternative to stabilize white wine proteins, because the temperature exposition is the major factor of instability after bottling, but more detailed studies are still needed to confirm these results.

References

[1] OIV, 2006, Ed. Officielle. Paris. [2] V. L. Singleton, T. E. Kramling, 1976, Am. J. Enol. Viticult. 27, 157-160

Acknowledgements

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