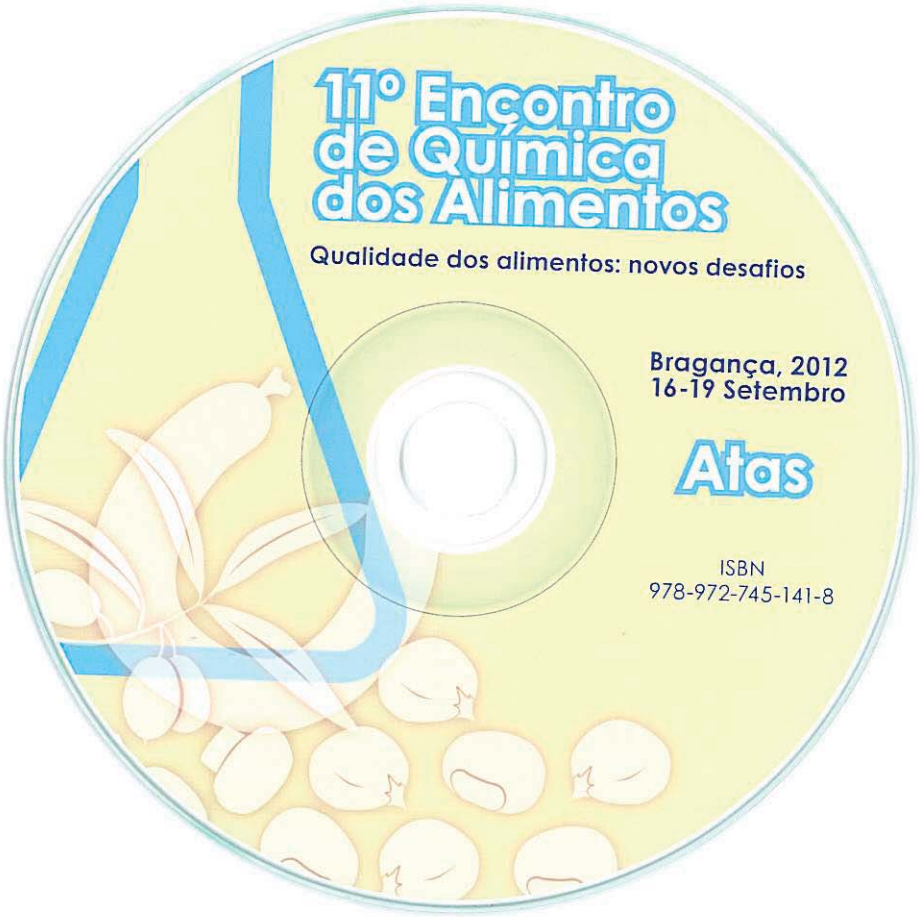
11º Encontro de Química dos Alimentos
Qualidade dos alimentos: novos desafios
Bragança, 2012
16-19 Setembro
Atas
ISBN
978-972-745-141-8

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

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Keywords: white wine; protein stability; bentonite; mannoproteins; stability tests

ABSTRACT

One of the most common physical instability is the development of protein hazes in white wines. Bentonite (B) is widely used for the treatment of protein instability however in excess it adversely affects its sensorial properties. Thus, the main objective of this study was to compare the efficiency of different B and mannoproteins (MP) on removal protein hazes, and then developing new strategies for protein stabilization. Two tests have been used to assess the stability of wines: heat-test and TCA-test. The effects of treatments on phenolic compounds, chromatic and sensory characteristics of wines were evaluated. Results showed that both B and MP increased protein stability but, MP also improved the sensorial characteristics of wines, indicating that can be an alternative to stabilize wine proteins.

1. INTRODUCTION

Wine protein fractions and their quantity in wine depends on some factors such as grape variety, climate conditions, soil type, growth environments in the vineyard, maturity and winemaking process [1, 2]. Although B is not specific for proteins and thus may remove other charged species or aggregated [3, 4], this is the most commonly used process to prevent the formation of protein turbidity in white wine. Their efficiency depends of the type and level of B addition, wine temperature, pH and composition [5]. The addition of B could affect wine quality like removal of colour, flavour and the texture compounds changing in these way sensory properties of wine [6]. Thus, right dose of B must be previous determined by stability tests [7]. Alternative techniques for B fining have been studied such as ultrafiltration [8, 9], addition of proteolytic enzymes [10-12], flash pasteurization [13, 14], alternative adsorbents [15], zirconium oxide treatment [1, 16] and the use of some MP [17].

Consequently, the main objective of this study was to evaluate effect of different types of B and MP on white wine protein stability, to get new approaches to stabilize them, namely on phenolic composition, chromatic and sensorial characteristics.

2. MATERIAL AND METHODS

Wine samples: A white wine from Douro Valley 2011 vintage was used in these trials. The main characteristics of wine 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.

Protein stability experiments: Five different types of bentonites (B1- activated sodium and calcium, B2 - activated calcium, B3 - natural calcium, B4 - sodium and calcium activated, B5 - natural sodium), and eleven types of mannoproteins (M1, M2, M3, M4, M5, M6, M7, M8, M9, M10, M11) with different molecular weight and extractions processes (chemical and enzymatic) 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.

Analytical methods: Alcohol, specific gravity, pH, titratable acidity and volatile acidity analysis were performed using a FTIR Baccus. Heat test [18] and tricloroacetic acid test [19] were performed to access protein stability. Chromatic characteristics and colour analyses were carried out according to standard methods of OIV [20]. Flavonoid phenols and non-flavonoid phenols content were determined using the absorbance at 280 nm before and after precipitation of the flavonoid phenols with formaldehyde [21]. The browning potential was determined according to the methodology proposed by Singleton and Kramling [22]. All analyses were performed in duplicate.

Sensory analysis: Sensorial analyses were performed by a trained panel; fifteen attributes were selected: visual (limpidity, colour), aroma (aroma intensity, fruity, floral, vegetable, oxidized, chemist) and taste (sweetness, acidity, bitterness, flavour intensity, body, balance, persistence). The attributes were quantified using a ten-point intensity scale [23].

Statistical analysis: Analysis of variance (ANOVA) of both physicochemical and sensory data as well as Principal Component Analysis (PCA) for sensory data was performed using the Statistica 7 software (Statsoft, OK, USA).

3. RESULTS AND DISCUSSION

Protein stability test: The results obtained from the protein stability test could be observed in Table 1. Protein stability was assayed using two different methods, the heat test which provides information about protein thermal stability and TCA test that provokes denaturation of almost of the wine proteins, because is a strong acid test. All B stabilized the wine according to the heat test, with an exception in the TCA test for bentonite B1. As expected, these results confirmed the efficiency of B on removing wine proteins. Considering the MP it was observed high thermal protein stability since 9 onto of 11 studied MP stabilized the wine by the heat test (Table 1). In opposite, results of TCA test in all the trials were unstable, probably because an increase in wine proteins concentration occurred after MP addition.

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 (-).

Phenolic and chromatic parameters: B fining had no effect on total phenols, flavonoids and non-flavonoid compounds; however some MP, with exception of M9, M10 and M11, decreased the concentration of total phenols. Lightness was improved in all wines with exception of wine treated with MP M2. The value for b* (yellowness) decreased with all B and with some MP (M2, M5, M6, M8). Results obtained for wine colour showed the same tendency. The colour variation compared the (ΔE*) treated with untreated wine, showed the greatest value (> 2 CIELab units) for wine treated with mannoprotein M2 which means that the colour of this wine could be distinguished by the human eye.

Sensory evaluation: After sensory analyse no significant differences among the wines were observed. However, PCA analysis 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 (Figure 1). The wines in group II were the highest scored and the wines from group I and III the lowest scored.

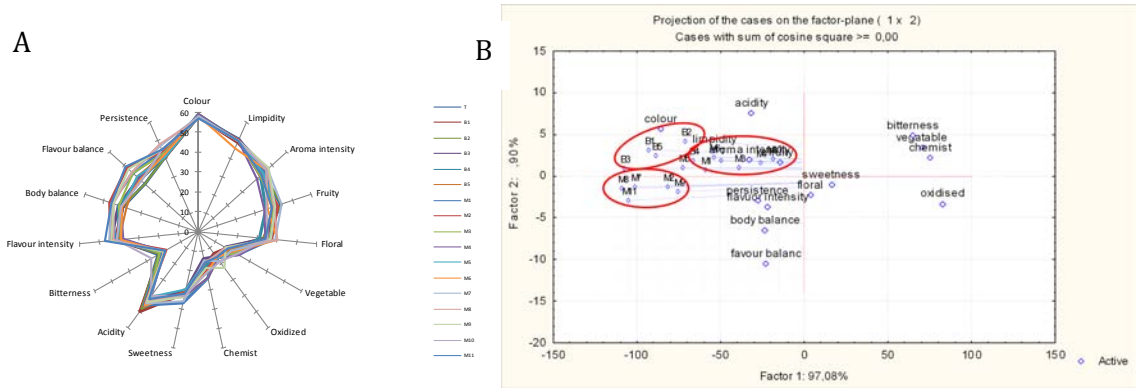

Figure 1. (A) Sensory profile of white wine obtained by the mean of the scores given by the painelists. (B) PCA analysis projection sensorial wine samples.

4. CONCLUSIONS

Results of this work confirmed relative good efficiency of B to remove unstable white wine proteins, and interesting results were obtained with MP, because high thermal stability of white wine proteins was achieved. Furthermore, MP seems to improved sensorial

characteristics of wine. So, MP could be an alternative additive to stabilize white wine proteins, because the temperature exposition is the major factor instability after bottling, but more detailed studies are still needed to confirm the results obtained in this work.

5. Acknowledgements

This work was partially funded by the Microbiology and Wine Biotechnology Unit of IBB/CGB-UTAD. Additional thanks to SAI-Segurança Alimentar Integrada, Lda, AEB Bioquímica Portuguesa, S. A. and Enartis companies for providing fining agents.

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