

# Impact of ion exchange resins versus oenological additives on wine quality

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## Introduction

Tartaric acid is easily ionized, leading to the formation of precipitates like potassium hydrogen tartrate (KHT) and calcium tartrate (CaT). Although, not harmful to consumer health, these precipitates leads to a decrease in the commercial value of the wine. To prevent the occurrence of these precipitations several treatments can be used. Among them, ion exchange resins are an accepted stabilization process by the OIV according to the Resolution 43/2000, as well as the treatment with oenological products such as metatartaric acid, since 1970, and carboxymethylcellulose, since 2009.

## Aim

The objective of this work was to compare the impact of ion exchange resins with oenological additives, such as CMC's with different structural features, and metatartaric acid, on wine quality.

## Material and Methods

### Wine sample

	White wine (Douro 2015)	Red wine (Douro 2013)
Alcohol content (%v/v)	13.00	12.00
Specific gravity (g/cm <sup>3</sup> )	0.9880	0.9930
Titrate acidity (g/L tartaric acid)	5.10	4.87
pH	3.32	3.61
Volatile acidity(g/L de acetic acid)	0.27	0.38

### Oenological additives

**CMC1-** 5% carboxymethylcellulose solution

**CMC2-** 20% carboxymethylcellulose solution

**CMC3-** solid carboxymethylcellulose

**Metatartaric acid**

**Ion exchange resins:** pH-Stab/AEB laboratory The experiment was carried out at Gran Cruz Winery, percentage of wine to be treated : 20% (total of 1000L) for white wine and 30% (total of 1000L) for red wine.

### Parameters analyzed in the wine

Parameters analyzed	Method
Conventional oenological parameter	FTIR Baccus
Chromatic characteristics and color	OIV (2015)
Total phenols, flavonoids and non-flavonoids	Kramling and Singleton (1969)
Phenolic profile by HPLC	Guise et al. (2014)

**Sensory analysis:** performed by a trained panel of 7 members, fifteen attributes - visual (limpidity, color), aroma (aroma intensity, fruity, floral, vegetable, oxidized, chemist) and taste (sweetness, acidity, bitterness, flavor intensity, body, balance, persistence), were assessed using a ten-point intensity scale (ISO 4121, 2003).

## Results

Table 1: pH and total acidity of treated white and red wines

	White Wine		Red Wine	
	pH	Total Acidity (g/L tartaric acid)	pH	Total Acidity (g/L tartaric acid)
<b>Meta. A</b>	3.27±0.00 <sup>b</sup>	5.59 ± 0.11 <sup>a</sup>	3.60±0.02	4.76 ± 0.05
<b>CMC1</b>	3.29±0.00 <sup>c</sup>	5.33 ± 0.00 <sup>a</sup>	3.71±0.06	4.76 ± 0.05
<b>CMC2</b>	3.37±0.00 <sup>d</sup>	5.49 ± 0.13 <sup>a</sup>	3.68±0.00	4.95 ± 0.32
<b>CMC3</b>	3.29±0.01 <sup>c</sup>	5.40 ± 0.05 <sup>a</sup>	3.72±0.00	5.06 ± 0.16
<b>Resins</b>	3.10 ± 0.00 <sup>a</sup>	6.15 ± 0.68 <sup>a</sup>	3.31±0.00	6.58 ± 0.08

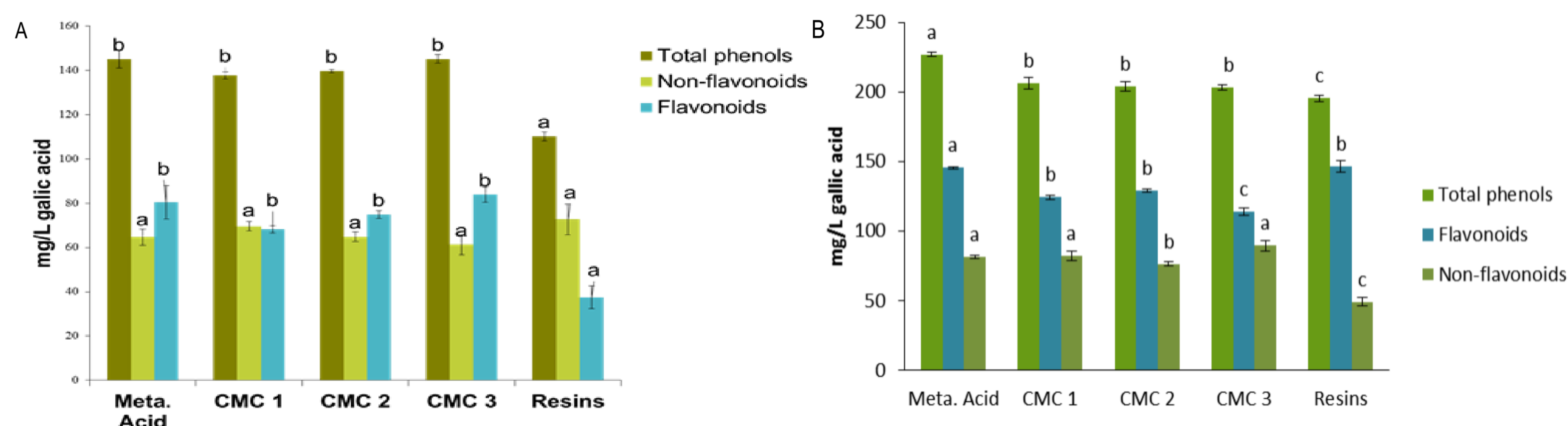


Figure 1: Flavonoids, non flavonoids and total phenolic compounds of white wine (A) and red wine (B).

Wine treated with resins showed lower pH and higher acidity compared to other treatments

Table 2: Calcium, magnesium, potassium and sodium concentration of treated white and red wine

	White wine				Red wine			
	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sodium (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sodium (mg/L)
<b>Meta. A</b>	21.00±0.42 <sup>b</sup>	85.85±4.16 <sup>a</sup>	646.27±1.88 <sup>b</sup>	31.30±5.6 <sup>1</sup>	52.15 ± 2.42 <sup>a</sup>	82.06±0.36 <sup>a</sup>	1083.00±9.93 <sup>a</sup>	37.40±0.14 <sup>a</sup>
<b>CMC 1</b>	20.70±0.00 <sup>a,b</sup>	81.06±4.04 <sup>c</sup>	597.48±9.92 <sup>a,b</sup>	93.59±51.2 <sup>b</sup>	45.29 ± 2.42 <sup>b</sup>	78.20±0.36 <sup>b</sup>	1040.43±18.25 <sup>c</sup>	88.70±0.56 <sup>c</sup>
<b>CMC 2</b>	21.30±0.00 <sup>a,b</sup>	83.07±0.00 <sup>b</sup>	766.86±29.09 <sup>a,b</sup>	98.03±0.90 <sup>c</sup>	47.00 ± 0.00 <sup>b</sup>	82.06±0.36 <sup>a</sup>	1072.52±19.76 <sup>b</sup>	100.55±1.06 <sup>d</sup>
<b>CMC 3</b>	21.90±0.00 <sup>a,b</sup>	80.38±2.61 <sup>c</sup>	645.35±125.36 <sup>b</sup>	75.70±6.08 <sup>b</sup>	41.86± 2.42 <sup>c</sup>	84.51±0.51 <sup>a</sup>	1061.15±6.14 <sup>b</sup>	73.30±0.70 <sup>b</sup>
<b>Resins</b>	19.45±0.92 <sup>a,b</sup>	71.72±0.83 <sup>d</sup>	473.43±24.89 <sup>a,b</sup>	49.35±0.78 <sup>a</sup>	31.57± 2.42 <sup>d</sup>	51.67±0.36 <sup>c</sup>	696.93±1.99 <sup>d</sup>	37.10±0.71 <sup>a</sup>

Calcium and potassium tends to decrease in all treated wines; Sodium is higher in the wines treated with CMC since they are sodium CMC.

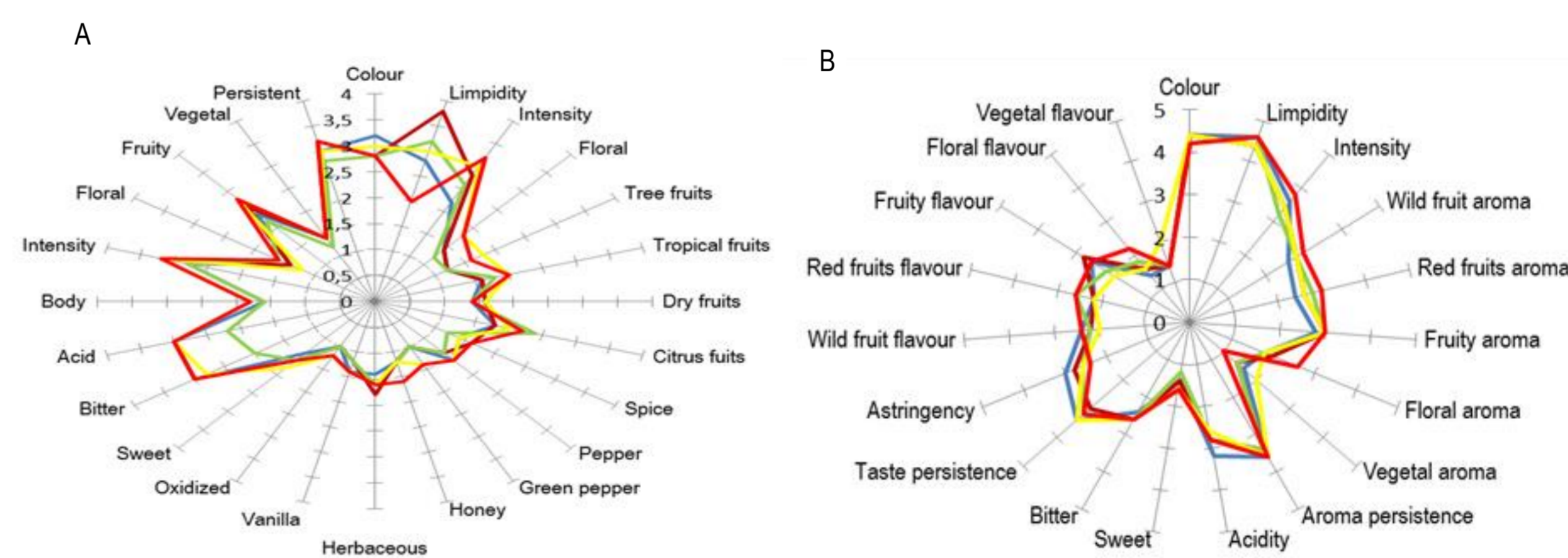


Figure 2: Sensory profile of white wine (A) and red wine (B) obtained by the average scores of the sensory analyze data

## References

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## Conclusions

White wine treated with ion exchange resins, presented lower concentration of total phenolic compounds compared to treated wines with oenological additives. Also, phenolic profile obtained by HPLC showed differences among treatments. Regarding white wine sensory characteristics, ion exchange resins seem to improve some sensory attributes, namely color intensity, in these treated wines. Similarly, red wines aroma and taste were also improved, when treated with ion exchange resins. These data suggest that wines treated with ion exchange resins, maintained or improved their quality.