# Comparison of ion exchange resins at industrial scale and enological stabilizers treatments for tartaric stabilization of white Port wine: Impact on wine physicochemical and sensory profile

**Daniela Moreira[1], Conceição Fernandes[2*], Rita Borges[1,2], Celeste Marques[3], Carlos Matos[1], Alice Vilela[1], Filipe-Ribeiro, L. [1], Fernando M. Nunes[1], Fernanda Cosme[1*]**

[1]Chemical Research Centre (CQ-VR), Food and Wine Chemistry Lab, UTAD, Vila Real, Portugal. [2]Mountain Research Centre (CIMO), ESA-Polytechnic Institute of Bragança, Portugal
[3]AEB Bioquímica Portuguesa SA, Zona Industrial de Coimbrões, Viseu, Portugal
* conceicao.fernandes@ipb.pt; fcosme@utad.pt;

## Introduction and Aim

A frequent cause of stability loss in a wine is the formation of crystalline salts of potassium bitartrate (KHT) that appears mainly at low temperatures, as a consequence of a large decrease in its solubility [1, 2]. Port wine is a Portuguese fortified wine produced exclusively in the Douro Valley demarcated region. There are only few studies regarding white Port wine tartaric stabilization, although its importance for consumers acceptance.

Therefore, the aim of this work was to perform the white Port wine tartaric stabilization by ion exchange resins at an industrial scale, and by the addition of oenological stabilizers, with the objective to compare the impact of these treatments on wine physicochemical and sensory characteristics.

## Material and Methods

### Wine sample

| White Port Wine (2015 vintage from Gran Cruz winery) | |
|---|---|
| Alcohol content (%v/v) | 16.9 |
| Specific gravity (g/cm³) | 1.0269 |
| Titratable acidity (g/L tartaric acid) | 3.3 |
| pH | 3.5 |
| Volatile acidity(g/L acetic acid) | 0.19 |

### Enological stabilizers

| CMC | Viscosity (mPas$^{-1}$) Solution 0.1% | Degree of substitution (DS) | Degree of polymerization kDa |
|---|---|---|---|
| CMC1 | 1.21±0.02$^{a}$ | 0,96±0.03$^{b}$ | 441±5$^{a}$ |
| CMC2 | 1.15±0.04$^{a}$ | 1.12±0.05$^{c}$ | 441±7$^{a,b}$ |
| CMC3 | 1.35±0.02$^{b}$ | 0.63±0.04$^{a}$ | 512±27$^{b}$ |

**Metatartaric acid**

**Ion exchange resins**: pH-Stab/AEB laboratory. The experiment was carried out at Gran Cruz Winery, percentage of treated wine was 20% of the wine..

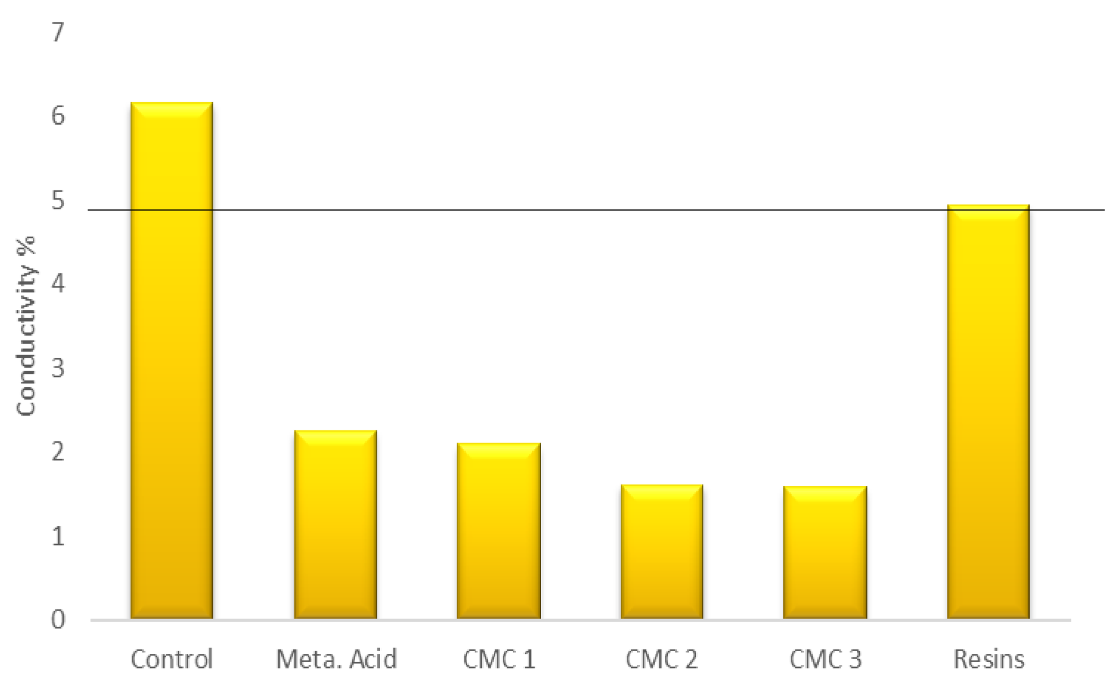
### Parameters analyzed in the wine

| Parameters analyzed | Method |
|---|---|
| Conventional oenological parameter | FTIR Baccus |
| Tartaric stability (Conductivity) | Mini contact test |
| Mineral composition | OIV [3] |
| Total phenols, flavonoids and non-flavonoids | Kramling and Singleton [4] |
| Phenolic profile by HPLC | Guise et al. [5] |

**Sensory analysis:** was performed by a panel of eight trained tasters, twenty-one attributes were selected and were quantified using a five-point intensity scale.

## Results

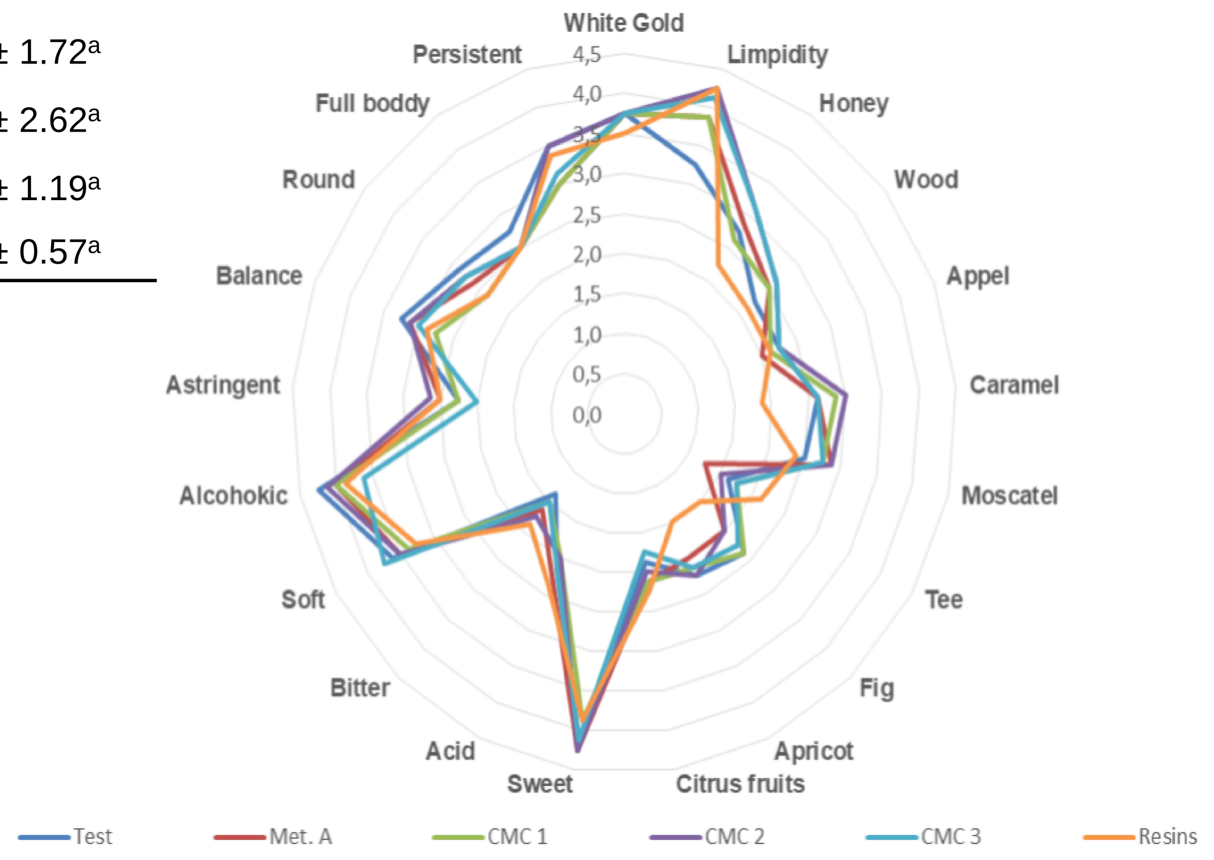
### Wine tartaric stability




### Wine mineral composition

| Sample | Calcium (mg/L) | Potassium (mg/L) | Magnesium (mg/L) |
|---|---|---|---|
| Control | 30.12 ± 0.37$^{a}$ | 642.57 ± 1.04$^{a}$ | 54.44 ± 0.23$^{a}$ |
| Meta. Acid | 31.03 ± 0.19$^{a}$ | 638.74 ± 4.50$^{a}$ | 58.42 ± 1.92$^{a}$ |
| CMC 1 | 32.08 ± 0.19$^{a}$ | 668.48± 3.16$^{a}$ | 57.58 ± 1.72$^{a}$ |
| CMC 2 | 31.69 ± 1.48$^{a}$ | 669.19 ± 4.38$^{a}$ | 56.94 ± 2.62$^{a}$ |
| CMC 3 | 32.34 ± 0.56$^{a}$ | 663,29 ± 2.91$^{a}$ | 56,91 ± 1.19$^{a}$ |
| Resins | 26.46 ± 0.93$^{b}$ | 568.83 ± 2.79$^{b}$ | 52.19 ± 0.57$^{a}$ |

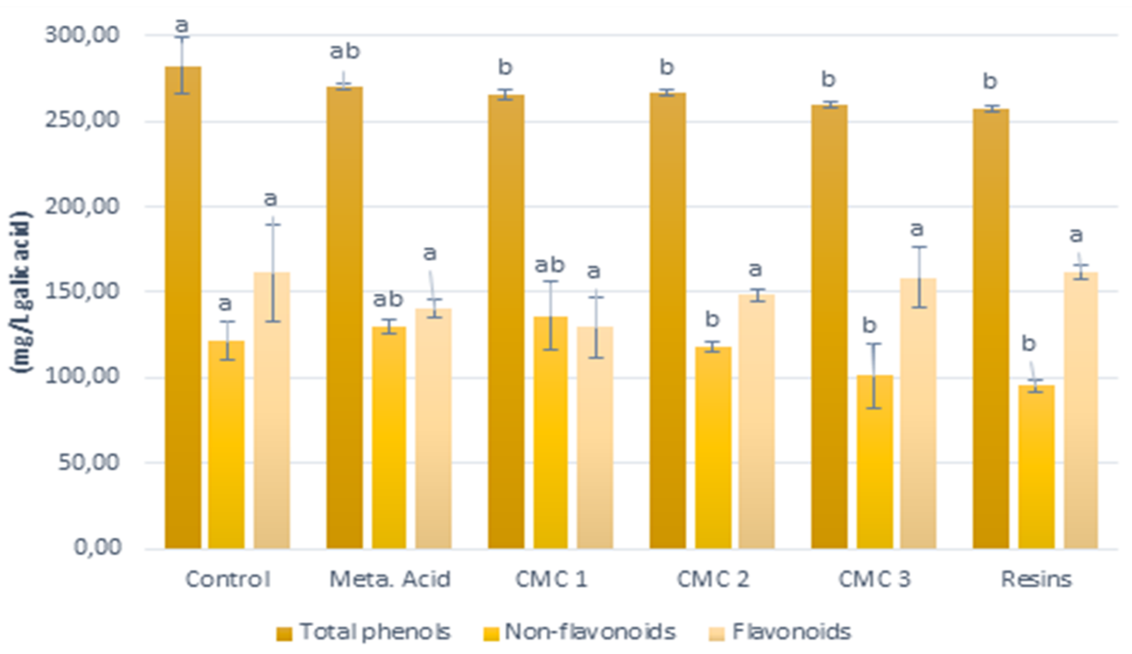
### Wine sensory profile




### Wine pH and total acidity

| Sample | pH | Total Acidity (g/L of tartaric acid) |
|---|---|---|
| Control | 3.53 ± 0.01$^{a}$ | 5.33 ± 0.11$^{ab}$ |
| Meta. Acid | 3.49 ± 0.01$^{b}$ | 5.48 ± 0.11$^{b}$ |
| CMC 1 | 3.48 ± 0.01$^{b}$ | 5.44 ± 0.05$^{b}$ |
| CMC 2 | 3.53 ± 0.02$^{a}$ | 5.24 ± 0.05$^{a}$ |
| CMC 3 | 3.54 ± 0.01$^{a}$ | 5.33 ± 0.11$^{ab}$ |
| Resins | 3.40 ± 0.00$^{b}$ | 5.86 ± 0.16$^{c}$ |

### Wine total phenols, non-flavonoid and flavonoid phenolic compounds




## References

[1] Berg, H. W., Keefer, R. Am. J. Enol. Viticult, , (1958), 9, 180–193. [2] Ratsimba, B., Laguerie, C., Biscans, B., Gaillard, M. Bull. Soc. Chim. Fr., (1989), 3, 325–330. [3] OIV (2015). Récueil de Méthodes Internationeiles d' Analyse des Vins et des Moûts. Paris, Edition Officielle. [4] Kramling, T. E., Singleton, V. LAm. J. Enol. Viticult, . (1969). 20, 86–92. [ 5] Guise, R., Filipe-Ribeiro, L., Nascimento, D., Bessa, O., Nunes, F. M., Cosme, F, Food Chem., .(2014). 156, 250–257.

## Acknowledgements

This work was funded by the Chemical Research Centre (CQ-UTAD). Additional thanks to AEB Bioquímica Portuguesa.

XXIV Encontro Luso Galego de QUÍMICA

## Conclusions

- ✓ As expected, all treatments assayed stabilized the white Port wine.
- ✓ Wine treated with resins showed lower pH and higher total acidity compared to wine without treatment.
- ✓ In general, treated wines presented a slight decrease in total phenolic compounds and non-flavonoid compounds.
- ✓ Concerning sensory analysis, wine treatment with ion exchange resins was more scored for the visual *limpidity* attribute and for the aroma attributes *citrus* and *tea*.
- ✓ These results show that ion exchange resins could be an interesting process for white Port wine tartaric stabilisation.