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Impact of wood species on the chemical composition, colour, and sensory characteristics of white wine

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This study evaluated the impact of using pieces of traditional oak, other oak species, and woods from different genera on the quality of white wine. The use of the different woods had minimal effects on the basic oenological parameters but modified the phenolic, chromatic, and sensory characteristics of the wine. The sensory panel preferred the wine aged with *Q. petraea*, followed by *Q. humboldtii* and *Robinia pseudoacacia*. This research advances understanding of the potential effects of different wood pieces on white wines, and underscored the significance of some woods that had not been previously studied.

Introduction

The use of wood results in changes in the composition and sensory properties of wine. Traditionally, *Q. petraea* and *Q. alba* have been the most commonly used, but alternative oaks and other wood species are currently being investigated as a potential cooperage wood source and as a strategy to diversify wines, thereby contributing to innovation and diversification. These woods have been mostly evaluated in red wines, thus knowledge regarding white wines is limited. The white wine market is dominated by young, fresh, and fruity wines, although the use of barrels or wood pieces is beginning to gain interest. Barrel aging promotes micro-oxygenation, but it can cause oxidation in white wines if air exposure is excessive. In this context, wood pieces represent a viable alternative provided that oxygenation is carefully controlled. Some of the woods studied in white wines are *Robinia pseudoacacia* (barrels and pieces), *Q. pyrenaica*, *Castanea sativa*, and *Prunus avium* (pieces)[1]. There are under-explored species, such as *Nothofagus pumilio* and *Q. humboldtii*, which have been evaluated in red wines[1] and others not yet used in winemaking, such as *Acacia dealbata* and *Q. candicans*. The chemical composition and physico-mechanical parameters of these alternative woods may influence the transfer of substances. This study evaluates the impact of traditional woods (*Q. petraea* and *Q. alba*), other oak species (*Q. humboldtii* and *Q. candicans*), and other genera (*Robinia pseudoacacia*, *Acacia dealbata*, *Prunus avium*, and *Nothofagus pumilio*) on the quality of white wine.

Wood, wine, and analysis

A young Verdejo white wine from the 2023 vintage (pH 3.14, total acidity 5.8 g/L, volatile acidity 0.37 g/L, 12.53 % v/v alcohol, TPI 9.4, free SO_2 25 mg/L, total SO_2 76 mg/L) was maintained in contact with the following wood for 20 days at 80.3 cm^2/L in 600 mL vessels: RP (*Robinia pseudoacacia*), AD (*Acacia dealbata*), PA (*Prunus avium*), NP (*Nothofagus pumilio*), QC (*Q. candicans*), QH (*Q. humboldtii*), QPR (*Q. petraea rumano*), QPF (*Q. petraea francés*), and QA (*Q. alba*). The woods had been naturally seasoned and convection-toasted (210 °C, 2 h, medium level) in an industrial oven and the staves cut into pieces measuring 16 × 7.8 × 2 cm. There was also a control wine without wood contact (CT). Oenological parameters (OIV methods), spectra, and phenolic compounds were analysed by UV-Vis spectrophotometry, while sensory characteristics were evaluated through hedonic preference tests (28 consumers) and descriptive profiling (17 expert tasters).

Effect of different woods on the composition and colour of white wine

In general, the oenological parameters (alcohol, sugars, pH, and total acidity) were unaffected or minimally affected. Volatile acidity increased in wines aged with wood, except for the AD wine, but remained within legal limits and was not perceptible in the sensory evaluation. Free SO_2 decreased in the wines containing wood, with PA, NP, QC, QPR, and QA exhibiting the lowest levels of both free and total SO_2.

After 20 days, wines aged with wood showed higher phenolic content than the CT (Figure 1), consistent with previous studies[1]. In the CT, phenolic content decreased by 5 %, whereas it increased by 3–22 % in the wines aged with wood. The AD, RP, and PA wines showed the highest phenolic content, and QH the lowest. Other studies have also reported higher

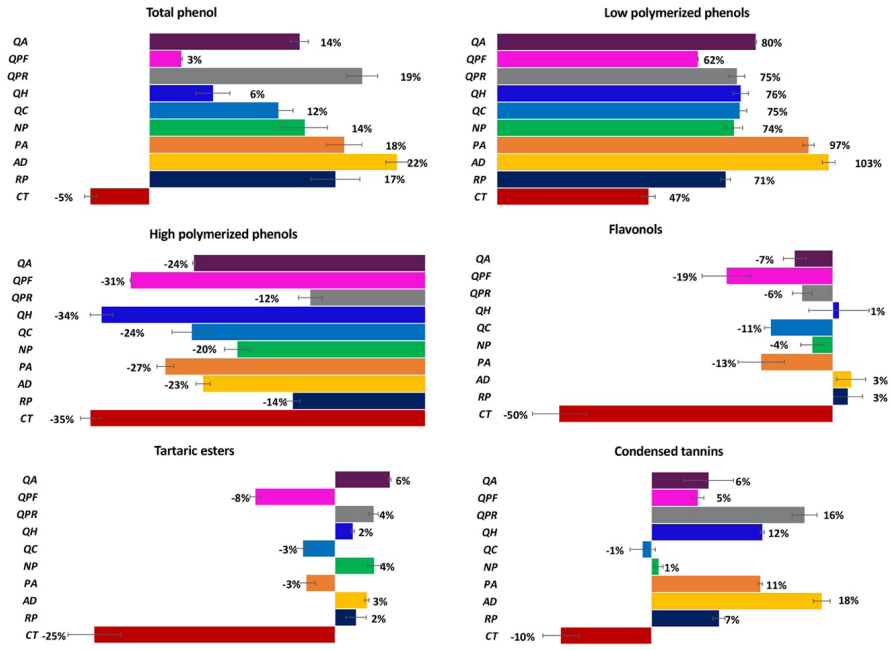


FIGURE 1. Percentage difference of wines without wood (CT) or with different types of wood (RP, AD, PA, NP, QC, QH, QPR, QPF, and QA) after 20 days compared to the initial wine.

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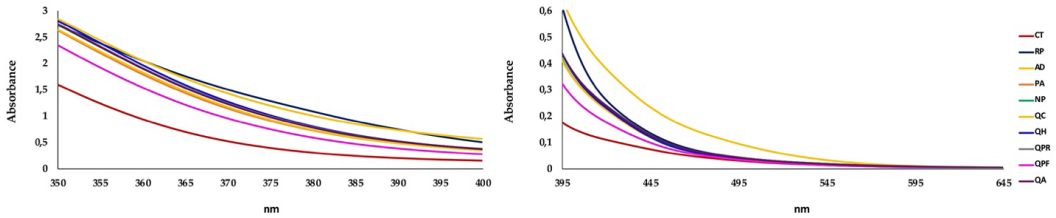


FIGURE 2. Spectrum of Verdejo wines after 20 days without wood (CT) or with different types of wood (RP, AD, PA, NP, QC, QH, QPR, QPF, and QA).

phenolic content with RP and PA woods compared to traditional oaks[2]. The CT wine showed the greatest loss of highly polymerised phenols (35 %), similar to QH (34 %) and QPF (31 %). Wines with the lowest loss of these phenols were RP and QPR. In the CT wine, the decrease of these compounds was associated with a 47 % increase in low-polymerised phenols. In wines aged with wood, this increase was at least 15 % higher than in the CT, indicating the release of phenols from the wood. The AD wine exhibited the highest extraction of low-polymerised phenols. Flavonols (yellow pigments and antioxidants) decreased in the CT, the phenols being the most affected, with a reduction of 50 % (Figure 1). Without wood, their stability was lower, likely due to the high instability of flavonols in their free form, whereas contact with wood reduced this loss (4–19%) and RP, AC and QH wines even showed stability or an increase. The observed increase in RP, AC y QH wines suggests a possible release of flavonols from these woods, particularly in the case of *R. pseudoacacia*, where their presence has already been reported. Regarding tartaric esters, the levels in wines aged with alternative woods were comparable to those in wines aged with traditional woods. The CT wine showed a 25 % decrease, which was also observed in the PA, QC, and QPF wines, albeit more moderately. In the other wines aged with wood, tartaric esters increased (2–6 %), possibly due to the release of phenolic acids, which may have increased their stability. Total condensed tannins (associated with bitterness, body, and astringency) decreased by 10 % in the CT wine, whereas in wines aged with wood they were maintained (NP, QC) or increased, particularly in AD, possibly due to the condensed tannin content of this wood.

The spectra in the range of 335 and 470 nm showed higher absorbance in the wines containing wood; all other differences with CT were smaller or inexistant (Figure 2). All wines aged with wood exhibited higher colour intensity, particularly AD and RP, while the remaining wines showed similar values among them. The AD wine was the only wine that showed an increase at 520 nm and 420 nm, maintaining its hue. In the other wines, including CT, absorbance at 520 nm did not increase, resulting in a higher hue. The PA, AD, NP, and QH wines showed higher values at 335 nm, suggesting a greater content of hydroxycinnamic acids. Between 345 and 355 nm, AD and QH wines exhibited the highest values, attributable to glycosylated flavonols.

Sensory analysis

The QPF wine was the preferred one (41%), followed by those made with alternative woods: QH (23 %) and RP (18 %) (Figure 3). Although acacia is already a valued wood for white wines, *Q. humboldtii*, a previously unstudied option, stood out as a promising alternative, as the white wine aged with this wood was the second most preferred by the tasters. All evaluated variables showed significant differences, except for frankness and bitterness. In the visual phase, the tasters confirmed the chromatic differences observed in the spectrum, highlighting the intensity and golden hue of the AD wine, and the lower intensity with greenish tones of the CT wine. In the olfactory phase, wines with QPR and QH showed enhanced aromatic intensity, probably due to an increased presence of woody and toasted notes. Frankness was similar in all wines, indicating the absence of off-flavours. Wines aged with wood showed lower intensity of fruity, floral, and vegetal aromas, which is expected due to the overlapping effect of compounds released from the wood. The NP wine best preserved the varietal aromas, in line with previous studies[3]. Vanilla aroma was more intense in wines aged with traditional woods, which can be attributed to their higher content of vanillin and lactones, enhancing the vanilla attribute. Spicy and dried fruits aromas increased in wines aged with wood, particularly in QPR, and overall, wood contact enhanced the aromatic complexity of the wines, with AD and PA showing the lowest complexity, similar to QPF. In the taste phase, wines aged with wood showed lower acidity, higher astringency, persistence, and body, with no significant differences compared to CT (Figure 3).

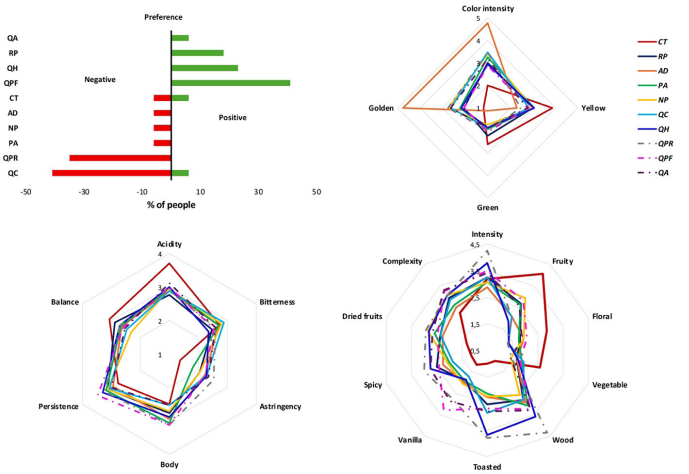


FIGURE 3. Taster preference and sensory profile of wines after 20 days without wood (CT) or with different types of wood (RP, AD, PA, NP, QC, QH, QPR, QPF, and QA).

Conclusions

Wines in contact with the studied woods showed significant changes in phenolic composition, chromatic characteristics, and sensory profiles. Acacia woods (RP and AD) increased the total phenolic content in the wines, particularly those with low polymerisation. Flavonol content was higher in RP, AD, and QH wines, suggesting release from the wood. Contact with wood allowed the wines to preserve or enhance tartaric esters, thereby promoting oxidative stability. Condensed tannins were higher in wines exposed to AD, PA, and RP woods, in line with their phenolic content. The interaction of wine with AD and RP woods led to an increase in UV-visible absorbance due to phenolic release. Sensory analysis revealed differentiated profiles, with the wine in contact with QPF wood being the most appreciated, followed by QH and RP, highlighting the potential of non-traditional woods for use in white. ■

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1 Martinez-Gil, A.M.; del Alamo-Sanza, M.; Sánchez-Gómez, R.; Nevares, I. (2020). Alternative woods in enology: Characterization of tannin and low molecular weight phenol compounds with respect to traditional oak woods. A review. *Molecules*, 25, 1474. https://doi.org/10.3390/molecules25061474.

2 Délia, L.; Jordão, A. M.; Ricardo-da-Silva, J. M. (2017). Influence of different wood chips species (oak, acacia and cherry) used in a short period of aging on the quality of 'Encruzado' white wines. Mitt. Klosterneuburg 67, 84-96.

3 Jordão, A.M.; Correia, A.C.; Botelho, R.V.; Ortega-Heras, M.; González-SanJosé, M.L. (2025). Phenolic content, volatile composition and sensory profile of red wines macerated with toasted woods from different South American botanical species. *J Food Compost Anal.*, 137, 106854. https://doi.org/10.1016/j.jfca.2024.106854.

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