



## The use of oak chips during the aging of a red wine in stainless steel tanks or used barrels: effect of the contact time and size of the oak chips on aroma compounds

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- Ageing wine in barrels increases wine aroma complexity due to the compounds extracted from the wood – even though wine internal reactions and evaporation of volatile compounds also play a role. These extracted compounds include: *lactones*, which are higher in American oak than in French oak; *guaiacol*, formed during oak toasting; *vanillin*, which is present in green wood but which normally increases with seasoning; and *furfuryl compounds*, which also form during toasting. Unfortunately, wood can also contribute a negative class of compounds –*ethylphenols*- which are formed by the decarboxylation of phenolic acids in the wood by *Brettanomyces*.
- In 2006 the European Union countries approved the use of oak chips in winemaking, and established how to designate the wines that had received this treatment. In this paper, these Spanish authors study the influence of adding oak chips to a wine being aged in either stainless-steel tanks or used barrels, and they compare the results with the same wine aged in new barrels.
- The wine was a 2004 Monastrell (synonym for Mourvedre). The barrels were made from American white oak, with a medium toast level (200°C for 30 min). “Used” barrels had been previously used 7 times to age Monastrell wine, and were sanitized by burning sulfur. To see the influence of chip *size*, researchers compared the use of powder, shavings, or cubes (10x6x4 mm) (all American oak). To see the influence of *contact time*, they matured the wine for 3, 6, or 9 months. All experiments were carried out in triplicate. Commercially, wood ageing is normally followed by some anaerobic ageing in bottles. So the researchers measured the main oak compounds present in the wine immediately after completion of the treatment, *and* after 6 months of bottle ageing.
- Rather than look at the effect of treatment on each oak compound, I have rearranged the results to try to highlight the main effects of type of container, size, and contact time, on the different oak compounds.
- **Effect of type of container.** In general, tanks without chips (control) showed negligible levels of furfural and lactones –proof of the wood origin of these compounds. However, over time, they did show significant concentrations of vanillin and ethylphenol –proof that these compounds can form in the wine from sources other than wood. Used barrels+chips tended to have higher levels of most of these compounds than tanks+chips. Finally, new barrels showed the highest levels of most compounds of wood origin (furfural, methyl-furfural, lactones). The exceptions were vanillin (for which *chips* were a greater source than new barrels), and ethylphenol and ethylguaiacol (for which *used barrels* and *contact time* were a great source than new barrels).

- **Effect of chip size.** In general, cubes were a little bit more effective than shavings or powder. More specifically, chip size did not have an effect on furfural levels. But cubes and shavings produced higher levels of lactones than powder – proving that they were present before the toasting, otherwise, more would be found in smaller formats. Finally, cubes also produced the highest levels of vanillin (normally, finer pieces tend to produce more vanillin, but if the size is too small, losses take place due to evaporation).

- **Effect of contact time.** Time affected oak compounds in two opposing directions: it affected *extraction*, and in some instances, it affected the *conversion* of the extracted compounds into other compounds. For instance, furfural levels were highest after 3 months of contact time with chips, but levels decreased after 6 and 9 months of contact. This is because, for longer extractions, conversion of furfural (furanic aldehydes into the corresponding alcohols) exceeds extraction, therefore furfural levels went down with time when using chips. The same was true for vanillin in the presence of chips. Vanillin is modified overtime by yeast activity into non-aromatic compounds, and after 6 and 9 months of contact, conversion exceeded extraction and levels went down. In contrast, with new barrels, both vanillin and lactones continued to be extracted for longer periods. This was one of the main conclusions of the study, that is, the **chips provided a much faster rate of extraction of the compounds studied, compared with the slow and sustained extraction provided by used and new barrels.**

In summary, the type of wood used in the maturation of wines led to important differences in their aromatic composition. *Chips* released aromas very rapidly; the wines in *new barrels* kept extracting aromas for longer periods; and the wines in *used barrels+chips* had a behavior in between. In the authors' opinion, oak chips are a good choice for short-term ageing and can add certain characters to used barrels, but overall quality is better with new barrels. Wouldn't it be nice if in a future work the authors would be able to perform sensory evaluation of the wines subject to the different oak treatments?

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