IVES Technical Reviews vine & wine

https://doi.org/10.20870/IVES-TR.2022.7233

# Impact of barrel toasting on the cognac eau-de-vie sensory profile

**Mathilde Gadrat[1,2], Joël Lavergne[2], Catherine Emo[2], Pierre-Louis Teissèdre[1], Kléopatra Chira[1]**

1 Unité de recherche Oenologie, EA 4577, USC 1366 INRAE, ISVV, Univ. Bordeaux, Bordeaux INP, F33882, Villenave d'Ornon France
2 Courvoiser SAS, 2 places du château, 16200 Jarnac, France

During barrel production, the oak undergoes several processing stages that contribute to wine and brandy flavours. The toasting step is considered to have the most important influence on oak wood chemical composition as it causes the thermodegradation of some oak wood components. However, the effect of toasting on distilled spirit quality has not been thoroughly studied. Thus, the objective of this study was to determine the impact of barrel toasting on the cognac eau-de-vie sensory profile.

## Introduction

Ageing in oak barrels is included in the specifications of the controlled designation of origin of Cognac (AOC Cognac). Cognac is a French spirit made from double-distilled white wines (Ugni blanc being the principal grape variety) produced in the Cognac area. The contact of the wine with the wood, which can last for more than two years, results in an enrichment of the spirits with phenolic compounds, such as phenolic aldehydes, phenolic acids, coumarins, lignans, phenylketones or even hydrolysable tannins[1]. The oak wood will affect colour, structure and organoleptic complexity. Thus the different steps in the barrel-making process, such as seasoning and toasting, contribute to influencing the quality of both wines and spirits[2]. Barrel toasting is probably the most important step in barrel manufacturing, as it leads to the thermodegradation of wood compounds, which in turn leads to the release of new volatile and non-volatile compounds[3,4]. The goal of this study was to study the impact of toasting on cognac eaux-de-vie by characterising the eaux-de-vie sensorially after 12 months of ageing. In order to do so, the same young eau-de-vie from double-distilled *Grande Champagne terroir* (the grape variety was Ugni blanc) from the 2020 vintage was placed in new barrels that represented eight different toasting processes and consisted of four different temperatures (Light, Medium, Medium plus, High) and two different toasting durations (Normal and Slow) as shown in Table 1.

| Toast | Notation | Sum °C.min |
|---|---|---|
| Light toast (normal) | LTN | 3560 |
| Light toast (slow) | LTS | 5036 |
| Medium toast (normal) | MTN | 4566 |
| Medium toast (slow) | MTS | 5134 |
| Medium toast (plus) normal | MT+N | 5088 |
| Medium toast (plus slow) | MT+S | 6015 |
| High toast (normal) | HTN | 6892 |
| High toast (slow) | HTS | 7320 |

**TABLE 1.** Types of toast studied (adaped from Gadrat et al. 2022)[5].

## Results

### 1/ Impact of barrel toasting on eaux-de-vie perception

After a long training course, the judges came to a consensus regarding the descriptors to be used for studying the impact of barrel toasting (temperature and duration) on eaux-de-vie at 40 % (v/v) (as they are marketed at 40 % (v/v)). The seven chosen descriptors were: "leather", "freshness", "tobacco", "toasted", "dry wood", "sweetness" and "heat". In general, of the two factors toasting and duration, toasting temperature had a greater impact than duration. For toasting duration, only one descriptor was significantly affected by duration: "freshness". A normal toasting (N) of the barrel produced a more intense freshness than a slower toasting (S). Out of the seven consensus descriptors, five were significantly impacted by the toasting temperature of the barrel only: "dry wood", "leather", "tobacco", "toasted" and "sweetness" (Figure 1). This was therefore the main factor that discriminated and characterised the different eaux-de-vie. The eaux-de-vie aged in highly toasted barrels were significantly more intense in terms of "dry wood", "leather", "tobacco" and "toasted" notes compared to the eaux-de-vie in lightly toasted barrels. They were also significantly more intense in "dry wood" and "tobacco" notes than the eaux-de-vie in medium and medium+ toasted barrels. However, an eau-de-vie aged in a lightly toasted barrel was characterised by a higher "sweetness" intensity than the eaux-de-vie aged in medium plus and highly toasted barrels.

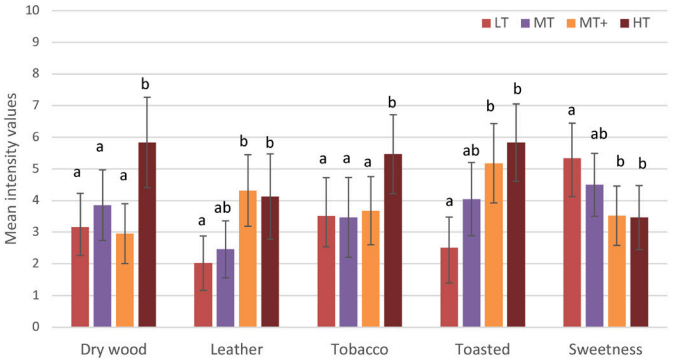



**FIGURE 1.** Descriptor intensity in eaux-de-vie at 40 % (v/v) with different barrel toasting temperatures (LT: Light toast, MT: Medium toast, MT+: Medium toast +, and HT: High toast). Error bar represents the confidence interval with a threshold of 0.05 (adaped from Gadrat *et al.* 2022)[5].

Under the conditions of this experiment, the "heat" notes were perceived as being the most intense in eaux-de-vie from highly toasted barrels, suggesting that the sensation of heating may influence the perception of sweetness. Studies have shown that high alcohol levels contribute to the sensation of "heating" or "hotness"[6] and alter the perception of sweetness[7]. It is therefore possible that the lower perception of sweetness in the eaux-de-vie from highly toasted barrels was linked to the intense "heat" sensation of the spirit.

The effect of toasting temperature was so important that clustering permitted to classify the eaux-de-vie into groups according to their sensorial proximity. Figure 2 shows that three groups of eaux-de-vie were formed. The first group contained the eaux-de-vie aged in highly toasted barrels and in a MT+S barrel. The second group consisted of eaux-de-vie aged in barrels with two medium toasts, MTN and MT+N. Finally, the third group was made up of eaux-de-vie aged in lightly toasted barrels and in MTS barrels. As there are no previous studies



The translation of this article into English was offered to you by Moët Hennessy.

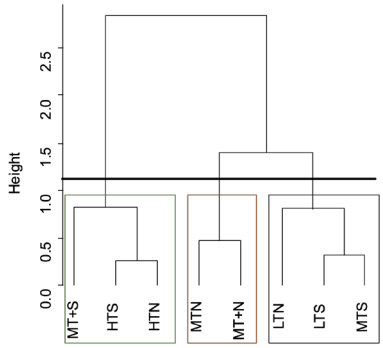



**FIGURE 2.** Clustering of eaux-de-vie based on the consensus descriptors for the eight products (adapted from Gadrat *et al.* 2022)[5].

on the impact of toasting on cognac eaux-de-vie from a sensory point of view, these results cannot be compared with other studies.

### 2/ Evaluation of eaux-de-vie quality

After the sensory profile, the eaux-de-vie were classified according to their olfactory and gustatory characterisation and to their overall quality using a ranking test. Each taster was asked to assign 1 point to the lowest-quality eau-de-vie and 8 points to the highest. The sum of the ranks was calculated for each modality for each ranking. As can be seen in Table 2, the highest sum of ranks in the olfactory and the overall quality ranking was observed for the eaux-de-vie aged with HTS and HTN barrels, followed by MT+S, LTS, MT+N barrels, and MTS, MTN and LTN barrels. The only difference was the significance level of differentiation among the samples: in olfactory ranking the level is higher (see letters showing the differences in Table 2). The gustatory ranking also shows a significant difference of 0.5 % among the products (Table 2), but the ranking differs. Unlike the results of the olfactory and overall quality ranking, the two high toasts showed a very different rank sum and did not differ from the light toast LTS. The eau-de-vie aged in the HTN barrel had the highest rank sum, but did not differ from the eaux-de-vie corresponding to the HTS, MT+S, LTS, MT+N and MTS barrels.

**TABLE 2.** Ranking of perceived quality in eaux-de-vie after 12 months of ageing in barrels representing different toasts (adapted from Gadrat *et al.* 2022)[5].

| | Eaux-de-vie and sum of ranks | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Test | HTS | HTN | MT+S | LTS | MT+N | MTS | MTN | LTN | F[a] | Results[b] |
| Olfactory | 87 a | 78 ab | 71 ab | 66 ab | 64 ab | 57 b | 53 c | 28 c | 26.6 | Significant at 0.1% |
| Gustatory | 63 ab | 85 a | 75 a | 72 a | 73 a | 58 ab | 37 b | 41 b | 23.7 | Significant at 0.5% |
| Global | 81 a | 76 a | 73 a | 72 a | 67 ab | 59 bc | 42 bc | 34 c | 23.6 | Significant at 0.5% |

[a]F was calculated as described in ISO 8587:2006 for the Friedman test. $F = (12 \times \Sigma_p^{i=1} R_i^2) / (j \times p \times (p+1)) - 3 \times j \times (p+1)$ where $j$ represents the number of judges, $p$ represents the number of products and $R_i$ represents the sum of the ranks for the modality i. [b] With eight products, the test was significant at 0.5% when F > 21.9 and at 0.1% when F > 26.1.

Figure 3 shows the results of the overall quality ranking test for the 40 % (*v/v*) eaux-de-vie according to toasting duration (Normal or Slow) for each barrel toasting temperature. When the duration is 'slow' the light toast results in higher quality than the medium toast, but to a lesser extent than the MT+ and HT toasts. On the other hand, when the toasting is 'normal' it is possible to differentiate the eaux-de-vie according to the toasting temperature, with high toasting temperatures resulting in a more qualitative eaux-de-vie than light toasting temperatures.

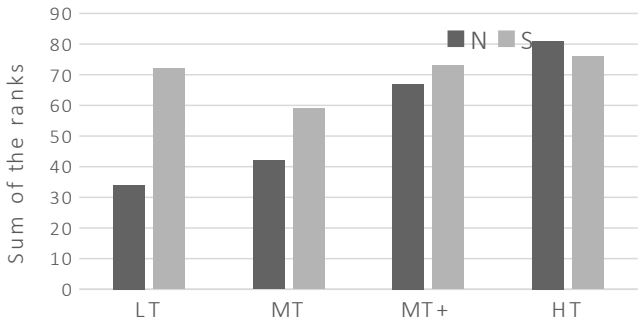



**FIGURE 3.** Results of the overall ranking of the 40 % (v/v) eaux-de-vie according to toasting duration (Normal or Slow) for each barrel toasting temperature (LT, MT, MT+ and HT) (adapted from Gadrat *et al.* 2022)[5].

## Conclusion

The objective of this study was to compare and sensorially characterise Cognac eaux-de-vie aged in barrels corresponding to different toasts. The effect of barrel toasting temperature was so marked that the eaux-de-vie could be distinguished according to their sensory profile after the first year of ageing. Eaux-de-vie aged in highly toasted barrels were significantly more intense in terms of "dry wood", "leather", "tobacco" and "toasted" notes compared to the eaux-de-vie in lightly toasted barrels. Eaux-de-vie aged in lightly toasted barrels were found to be significantly different from those aged in highly toasted barrels. The latter generally resulted in high quality eaux-de-vie. ■

***Source:*** *Sourced from the research article: "Sensory characterisation of Cognac eaux-de-vie aged in barrels subjected to different toasting processes" (OENO One, 2022).*


**1** Canas, S. (2017). Phenolic Composition and Related Properties of Aged Wine Spirits : Influence of Barrel Characteristics. A Review. *Beverages*, 3(4), 55. https://doi.org/10.3390/beverages3040055

**2** Canas, S., Belchior, A. P., Falcão, A., Gonçalves, J. A., Spranger, M. I., & Bruno-de-Sousa, R. (2007). Effect of heat treatment on the thermal and chemical modifications of Oak and Chestnut wood used in brandy ageing. *Ciência e Técnica Vitivinícola*, 22(1), 5 14.

**3** Cadahía, E., Muñoz, L., Fernández de Simón, B., & García-Vallejo, M. C. (2001). Changes in Low Molecular Weight Phenolic Compounds in Spanish, French, and American Oak Woods during Natural Seasoning and Toasting. *Journal of Agricultural and Food Chemistry*, 49(4), 1790 1798. https://doi.org/10.1021/jf0006168

**4** Chira, K., Anguellu, L., Da Costa, G., Richard, T., Pedrot, E., Jourdes, M., & Teissedre, P.-L. (2020). New C-Glycosidic Ellagitannins Formed upon Oak Wood Toasting, Identification and Sensory Evaluation. *Foods*, 9(10). https://doi.org/10.3390/foods9101477

**5** Gadrat, M., Lavergne, J., Emo, C., Teissedre, P. L., & Chira, K. (2022). Sensory characterisation of Cognac eaux-de-vie aged in barrels subjected to different toasting processes. *OENO One*, 56(1), 17–28. https://doi.org/10.20870/oeno-one.2022.56.1.4853

**6** Gawel, R., Sluyter, S. V., & Waters, E. J. (2007). The effects of ethanol and glycerol on the body and other sensory characteristics of Riesling wines. *Australian Journal of Grape and Wine Research*, 13(1), 38 45. https://doi.org/10.1111/j.1755-0238.2007.tb00070.x

**7** Zamora, M. C., Goldner, M. C., & Galmarini, M. V. (2006). Sourness–Sweetness Interactions in Different Media : White Wine, Ethanol and Water*. *Journal of Sensory Studies*, 21(6), 601 611. https://doi.org/10.1111/j.1745-459X.2006.00085.x



This work is licensed under a Creative Commons Attribution 4.0 International License.