

EFFECTS OF TEMPERATURE ON THE AROMA COMPOSITION OF HYDROLYSATES FROM GRAPE POLYPHENOLIC AND AROMATIC FRACTIONS (PAFs)

Sánchez Acevedo, Elyma; López Ricardo; Ferreira, Vicente

Laboratory for Aroma Analysis and Enology (LAAE), Universidad de Zaragoza, Instituto Agroalimentario de Aragón (IA2) (UNIZAR-CITA), 50009 Zaragoza (Spain)

esanchezacevedo@unizar.es

Introduction

In neutral grapes, most aroma compounds are present as non-volatile precursors. There is a strong evidence that supports the existence of a connection between the aromatic quality of wine and the content of aroma precursors in grapes¹. Due to this, several studies have been developed both for the chemical characterization of this set of precursors and for the biogenetic pathways involved, as well as for the development of quantitative methods for the global or detailed evaluation of the precursor fractions present in the grape. Harsh acid hydrolysis is considered to better reveal the aroma potential of winemaking grapes, because transformations taking place during fermentation include relevant chemical rearrangements in acid media that are better predicted by acid hydrolysis².

Alegre et al.³ proposed a method of extraction of the more specific aromatic precursors and acid hydrolysis under strict anoxic conditions. The hydrolysates obtained present sensory profiles congruent with olfactory nuances of unoxidized wine and they are specific for the grape variety.

Following the guidelines of that work the **objective** of this study is to evaluate whether acid hydrolysis at 75°C for 24 hours under anoxic conditions is a good method to evaluate the aromatic potential of the grape.

Material and methods



PAFs³
6 Garnacha (G)
6 Tempranillo (T)

Reconstitution in synthetic wine
Tartaric acid (5 g/L)
13 % of PAFs at pH 3.5

Anoxic Aging

Mild
(5 weeks 50°C)

Accelerated
(24 hours 75°C)

Quantification of aroma compounds by GC-MS^(4,5,6)

-Correlation studies
-ANOVA
-PCA

Results and Discussion

A total of 36 volatile compounds, classified into seven categories (terpenes, norisoprenoids, volatile phenols, vanillin derivatives, lactones, Strecker aldehydes and polyfunctional mercaptans), were quantified with an RSD between 2 and 15%. Some compounds have concentrations very relevant from the sensory point of view, like 1,1,6-trimethyl-1,2-dihydronaphthalene (TDN), β-damascenone, massoia lactone and 3-mercaptohexanol (MH).

ANOVA and PCA studies

Data were studied by two-way ANOVA, the factors being the type of hydrolytic procedure (accelerated or mild) and the PAF. The results of ANOVA study indicate that both factors exert a significant effect in all cases, but the strongest influence is exerted by the PAFs. This was expected because even though they are neutral varieties, they present differences from the point of view of the varietal aroma.

This behavior was corroborated by a PCA study; the graphic shows clearly two groups of samples separated by PC1: on the right side of figure 1 Garnacha samples and on the left side Tempranillo samples. On the other hand, although samples from mild hydrolysis are in the upper part and those from the harsh in the down part, differences are not very strong and relative positions of samples are maintained. This suggests that, in general terms, accelerated hydrolysis can be used to predict aroma released at 50°C. There are compounds that clearly differentiate the varieties regardless of the type of hydrolysis to which the sample was subjected. Some Garnacha samples presented higher levels of MH and 2-furfurylthiol (FFT) released at 50°C and some Tempranillo samples had 4-mercapto-4-methyl pentanone (MP) concentration levels of more than one magnitude order respect to Garnacha samples.

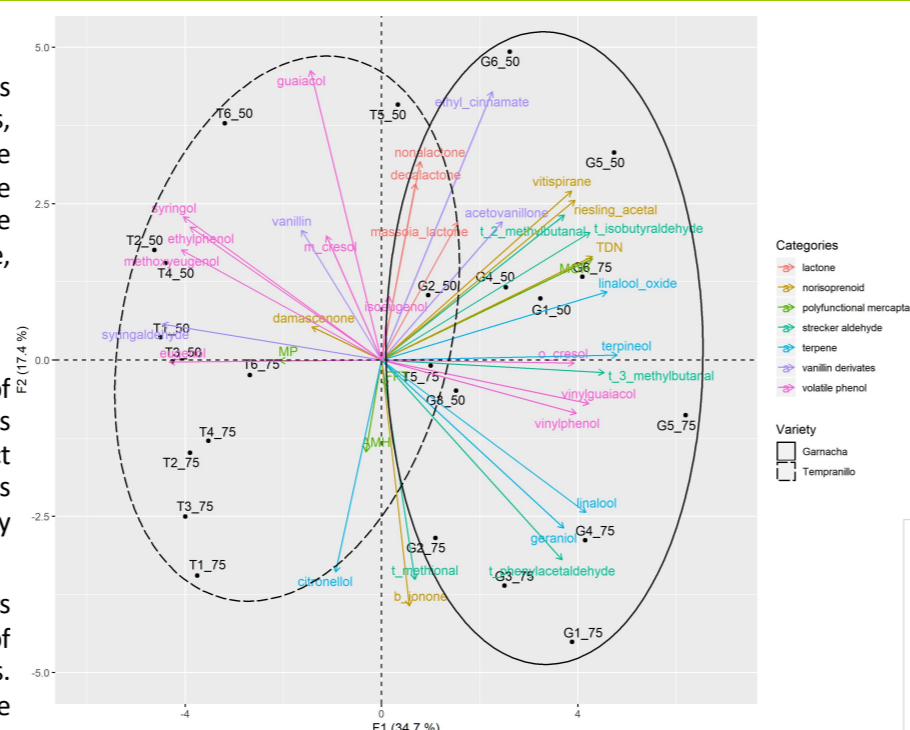


Fig. 1: PCA of the normalized concentrations of the 36 volatile compounds quantified on PAFs during anoxic aging at 50 and 75 °C

Correlation studies

The correlation studies shows a very good correlation between mild and accelerated acid hydrolysis with $R^2 > 0.9$ for 18 analytes, including very important compounds such as MH, massoia lactone, β-damascenone, vanillin derivatives and eugenol.

In the cases of TDN, guaiacol, 4-vinylguaiacol and 4-vinylphenol, the predictive capacity of accelerated hydrolysis at 75°C is more limited ($0.6 < R^2 < 0.9$), due that TDN and most volatile phenols steadily increase during aging; even, 4-vinylphenol and 4-vinylguaiacol follow more complex evolutions with at least two maxima, likely because of the number of precursors they have and their chemical reactivity⁷.

In the case of terpenes like linalool and geraniol, in both hydrolytical conditions they were poorly correlated. Data suggest they can be best represented by the accelerated hydrolysis.

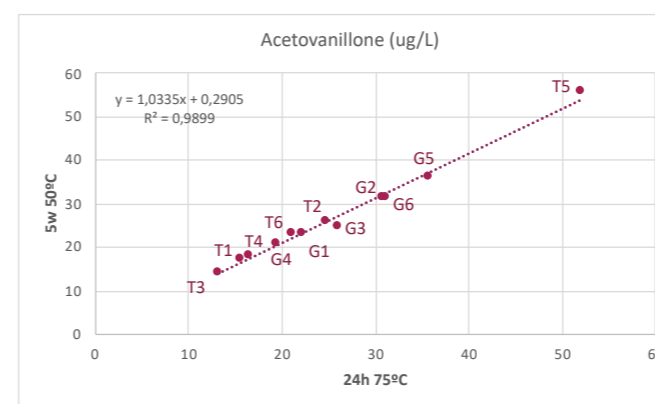


Fig. 2: Correlation of concentration of acetovanillone between aging at 75°C and 50°C

Conclusions

Accelerated hydrolysis at 75°C represents a good compromise that allows to obtain a satisfactory representation of most of the aromatic potential of the grape in a short period of time. In fact, labile compounds such as linalool and geraniol are best measured at this temperature. Only certain compounds related with long-aging aroma, such as TDN and 4-vinylguaiacol, are underestimated by the accelerated hydrolysis.

References

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