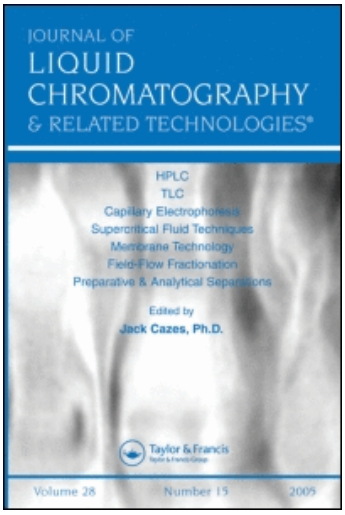

Journal of Liquid Chromatography & Related Technologies

Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t713597273

The Influence of Oak on the Furanic Aldehyde Contents of Distillates Subjected to Aging

M. Villalon Mir[a]; H. López[a]; Garcia De La Serrana[a]; C. López Martinez[a]; J. Quesada Granados[a]
[a] Department of Nutrition and Bromatology, Faculty of Pharmacy University of Granada, Granada, Spain

To cite this Article Mir, M. Villalon , López, H. , De La Serrana, Garcia , Martinez, C. López and Granados, J. Quesada(1991) 'The Influence of Oak on the Furanic Aldehyde Contents of Distillates Subjected to Aging', Journal of Liquid Chromatography & Related Technologies, 14: 19, 3615 — 3621
To link to this Article: DOI: 10.1080/01483919108049415
URL: http://dx.doi.org/10.1080/01483919108049415

JOURNAL OF LIQUID CHROMATOGRAPHY, 14(19), 3615-3621 (1991)

THE INFLUENCE OF OAK ON THE FURANIC ALDEHYDE CONTENTS OF DISTILLATES SUBJECTED TO AGING

M. VILLALON MIR, H. LÓPEZ GARCÍA DE LA SERRANA, C. LÓPEZ MARTÍNEZ, AND J. QUESADA GRANADOS
Department of Nutrition and Bromatology
Faculty of Pharmacy
University of Granada
18012-Granada, Spain

ABSTRACT

The furfural and 5-hydroximethyl furfural content was analyzed by H.P.L.C. in distilled alcoholic beverages subjected to different periods of aging in barrels of French Limousin and American Kentucky oak. The presence of these furanic compounds is not due to the length of time spent in the barrel. The age of the barrel, its manner of use and the charring process control the concentration of furanic aldehydes.

INTRODUCTION

Aging or maturation in oak barrels is a stage in the production of brandy which influences the final characteristics of the beverage. Cooperage techniques and the origin of the oak are therefore decisive factors in the aging process. The burning or charring process of the inside of the barrel helps the appearance of a series of compounds which the distillate later extracts from the wood (1).

Among these compounds are the furanic aldehydes: furfural and 5-hydroximethyl furfural, considered by some authors to be possible aging markers (2).

The presence of these furanic compounds is mainly due to the thermolysis produced in the wood during the charring process.

Furfural originates in the hemicellulose and 5-hydroximethyl furfural in the cellulose (3). They appear in the chemical composition of the distillate during the aging process and it is for this reason that they are, initially at least, considered as aging markers (4). However, although it seems clear that both furfural and 5-hydroximethyl furfural are extracted from the oak, we cannot discount the hypothesis that they may be formed during distillation (5).

Similarly, the different factors affecting the wood of the barrel (its origin, the techniques used in manufacture, etc.), together with the exhaustion of the barrel through use, have an influence on the relative concentration of these compounds in the aged beverage (6), to such an extent that we may even confirm the lack of significant differences between unaged and aged distillates (7).

The aim of this paper is to study the effects of the origin of the oak, barrel manufacture and usage on the production of brandies as regards the contents of substances with a furanic structure (furfural and 5-hydroximethyl furfural) and their possible applications as aging markers.

MATERIALS AND METHODS

Samples

We analyzed samples of a distillate aged for five years in different barrels made of different types of oak:

- French Limousin oak
- American Kentucky oak

These barrels were classified in three series, according to usage and age:

- New, charred barrels: Series A
- 5 year-old, burnt barrels: Series B
- New barrels: Series C

The barrels were charred at a constant temperature of 180°C.

Equipment

HPLC equipment consisted of a KONIK-500A chromatograph, a KONIK-UVIS-200 UV absorbance detector and a Hewlett-Packard HP 3394 A computing integrator.

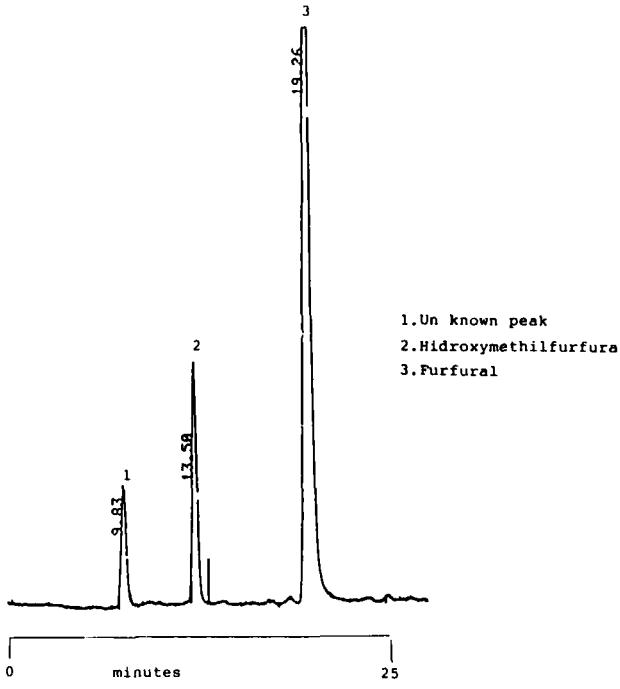

Figure 1: Chromatogram of a five years old distillate aged in a series A American Kentucky oak barrel.

Method

The technique employed was high power liquid chromatography (H.P.L.C.) by direct injection of samples, following the methodology of a previous study (8).

A Lichrospher 100-CH-18 column was used with a mobile phase of water-methanol (90-10 v/v) with 1 ml/min flow. The detector was an UV absorption spectrophotometer at 280 nm. 15 µl injected volume. The values obtained are shown in Fig. 1.

RESULTS AND DISCUSSION

The mean concentrations of furfural and 5-hydroximethyl furfural detected in the Series A distillate aged in Limousin oak were 9.62 and 2.14 mg/L respectively, whereas the same distillate

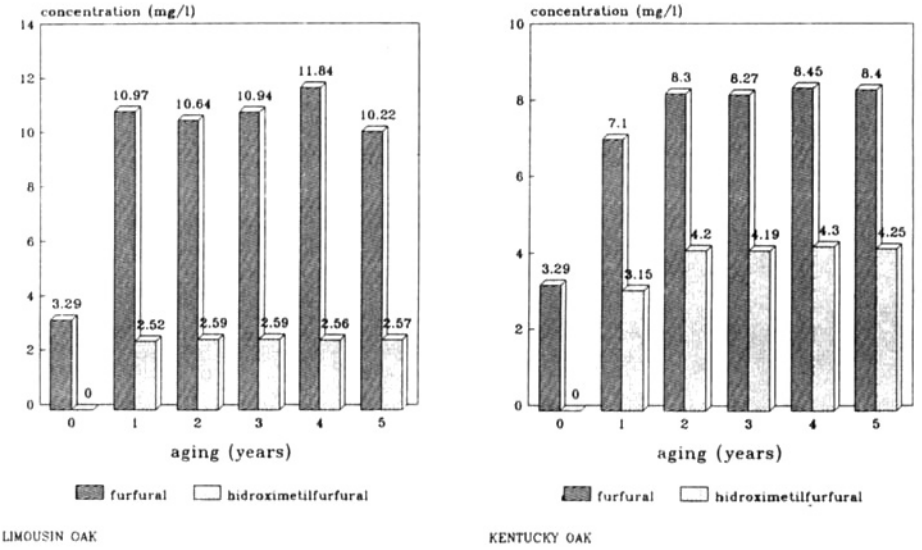

Figure 2: Furanic compounds present in A series.

aged in Kentucky oak presented concentrations of 7.30 mg/L furfural and 3.35 mg/L 5-HMF.

For the Series B distillate aged in Limousin oak the mean concentrations were 3.34 mg/L furfural and 0.21 mg/L 5-HMF. For the Kentucky oak barrel, the mean concentrations were 4.32 mg/L furfural and 1.46 mg/l 5-HMF. In both cases the age of the barrels determined the early exhaustion of the wood, which would explain the lower content of these compounds (Figs. 2 and 3).

For the distillate aged in the Series C barrels, the mean concentrations over the 5 years were 3.09 mg/L furfural and 0.15 mg/L 5-hydroximethyl furfural for the Limousin oak and 3.35 mg/l furfural and 0.075 mg/L 5-hydroximethyl furfural for the Kentucky oak. These values are similar to those of the unaged distillate before preservation in the different barrels, with a concentration of 3.29 mg/L furfural and no 5-hydroximethyl furfural.

On the basis of these results, there are no significant differences between the distillates aged in French Limousin oak and those aged in American Kentucky oak as regards the concentrations of furanic aldehydes.

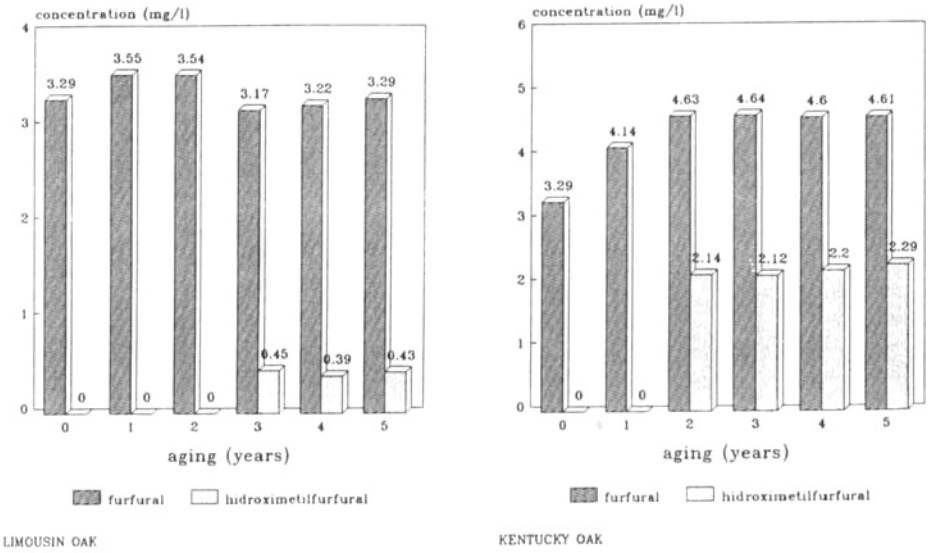

Figure 3: Furanic compounds present in B series.

On the other hand, there are differences between the Series A distillates and those of Series B and C. One factor affecting the contents of furfural and hydroximethyl furfural is the burning process of the inside of the Series A barrels (Fig. 2). Thus it was observed that the distillate kept in the Limousin barrel of this Series had a mean concentration of 11.76 mg/L in furanic components over the five-year period, whereas the same distillate stored in Series C barrels had a mean concentration of 3.24 mg/L (Fig. 4).

Another factor affecting the presence of furanic aldehydes is the age of the barrel. Considerable differences were observed in the content of these aldehydes between the distillates stored in new barrels (Series A) and those stored in used barrels (Series B). However, the concentrations of furfural and 5-hydroximethyl furfural remained practically unaltered in both series throughout maturation (Fig. 3).

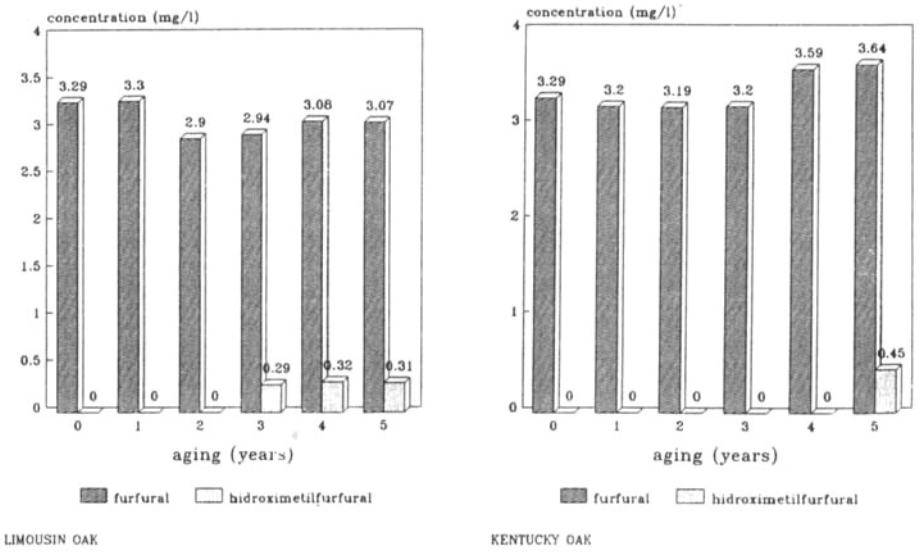

Figure 4: Furanic compounds present in C series.

DISCUSSION

The presence of these furanic compounds in aged distillates can not be considered an aging marker. In view of our results, the furfural would be mainly formed during distillation and thermolysis of the wood when it is charred, but not during the aging process.

5-Hydroximethyl furfural is, in general, detected in all the series from the third year on, in a lesser concentration than that of furfural. The proportion of furfural to 5-hydroximethyl furfural is in all cases greater than one. This compound would be mainly formed during the burning process through disintegration of cellulose.

The presence of furfural and 5-hydroximethyl furfural in the distillates aged in oak barrels is determined by three factors: the charring of the inside of the barrel, its age, and its manner of use. The amount of time spent in the barrel did not affect the presence of these furanic compounds in the distillates analyzed by us.

REFERENCES

(1) Gomez-Cordoves, C. and Delgado, T., Teneur des brandies commerciaux y espagnols en aldehydes et en acides phenoliques, Cahier Scientifique, 107, 39-43, 1987.

(2) Moutounet, Y.; Radier, Ph.; Puech, J.L.; Verette, E., Analysis by HPLC of extractable substances of oak wood application to a cherdonnay vine, Sciences des aliments, 9, 35-51, 1989.

(3) Puech, J.L. and Moutounet, M., Liquid chromatographic determination of scopoletin in hydroalcoholic extract of oak wood and in matured distilled alcoholic beverages, J. Assoc. Off. Anal. Chem., 71, 512-514, 1988.

(4) Pontallier, P.; Salagoity-Auguste, M.; Ribereau-Gayon, J., Intervention du bois de chêne dans l'evolution des vins rouges élevés en barriques, Connaqissance Vigne Vin, 16, n°1, 45-61, 1982.

(5) Guymon, J.F. and Crowell, E.A., GC separated brandy components derived from French and American Oaks, Amer. J. Enol. Viticult., 23, n°3, 1972.

(6) Onishi, M.; Guymon, J.F.; Crowell, E.A., Changes in some volatiles constituents of brandy during aging, Amer. J. Enol. Viticult., 28, 152-158, 1977.

(7) Profumo, A., Evolution of the Italian Distillate "grappa" during aging in wood: A gas chromatographic and high perfomance liquid chromatographic study, Amer. J. Enol. Viticult., 39, n°4, 1988.

(8) Villalón Mir, M.; Quesada, J.; López G³ de la Serrana, H.; López Martinez, M³.C., High Performance Liquid Chromatography determination of furanic compounds in commercial brandies and caramels. (waiting for publication).