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Oak Chips or Barrels?

The Barrel Aging article (pp.13-16, ICCVE's The Midwest Winegrower, Summer 2011), provided an overview of why and how the wine industry uses barrels. As indicated at the end of that article, a series of mini-articles would follow, each focused on a single, practical aspect of barrel usage. This is the second of the series, about oak chips vs. barrels (2).

During the late 1980's, a study was undertaken to compare wines aged within new oak barrels, within used barrels containing oak chips, and within stainless steel tanks with oak chips. (2). The new barrels were constructed of American white oak; the used barrels had been used once for the aging of Chardonnay wine. All vessels were the same volume, 50 gallons. The chips were obtained by disassembling one similar barrel and converting it into chips by a commercial chipping machine. The dimensions of the oak chips were approximately 1/4" thick, 3/4" long, and 3/8" wide.

The wine used in this experiment was a Seyval blanc vinified by an Ohio winery. All containers were filled from a single stainless steel tank.

The resulting wines were compared for differences in chemical composition and sensory properties. The chemical measurements included the usual pH, TA, VA, alcohol, color, residual sugars, and phenolics. Phenolic compounds in wine consist of several hundred chemical compounds that affect the taste, color and mouthfeel of wine; and are broadly divided into two categories - flavonoids and non-flavonoids. Flavonoids include the anthocyanins and tannins which contribute to the color and mouthfeel of the wine. The non-flavonoids include the anti-oxidant resveratrol and several phenolic acids, such as vanillic acid , which is responsible for a vanilla note in wines.

After 10 weeks storage, there was an average increased concentration in nonflavonoid phenols of 45 mg/L and 19 mg/L for the new- and used-barrel wines, respectively, i.e. 2.4 times greater than within the used-barrel wines.

To raise the level of nonflavonoid phenols in the wines in used barrels and stainless steel tanks to that of the new-barrel wines, oak chips were added to the carboy samples until the wines reached the level of nonflavonoid phenols found in the new barrel-aged wine. The wines were bottled 10 weeks after chip removal and similarly stored at 64°F.

Among five phenolic acids examined, only gallic acid increased among the wood-treated wines. The greatest increases occurred in wines from new barrels, followed by wines aged in used barrels and in stainless steel tanks with oak chips. It is known that an increase in galli cacid may indicate a decrease in astringency. The concentrations of the other 4 phenolic acids showed little or no effect of treatment, indicating there was very little extraction of these compounds from the barrel wood or oak chips.

The final chemical measurements, after the level of nonflavonoid phenols in the wines in used barrels and stainless steel tanks had been raised to that of the new-barrel wines, are summarized in the table below:

Table 1. Wine analysis of Seyval blanc wine aged using three different wood treatments.

Wood Treatment	pH	Titratable Acidity (g/L tartaric acid)	Volatile Acidity (g/100 mL acetic acid)	Alcohol %	Color (absorbance at 420 nm)	Reducing Sugars (g/100 mL)	Total Phenols (mg/L gallic acid)	Non-flavonoid phenols (mg/L gallic acid)
Control (Stain-less)	3.42	7.43	0.058	12.7	0.073	7.12	267	219
Oak Chips	3.42	7.36	0.059	12.6	0.085	7.12	307	261
Used Barrels	3.35	7.43	0.074	12.6	0.084	7.37	309	265
New Barrels	3.33	7.66	0.093	12.5	0.089	7.36	308	264

Statistically, only volatile acidity values for the used- and new-barrel wines were significantly higher than for the oak-chip wines and from control wines. Furthermore, volatile acidity was significantly higher in wines from new barrels than in wines from used barrels; also, pH (an exponential scale) was significantly lower for new and used barrels, in comparison to the control and the oak chips treatment.

Table 2: Aroma and taste ratings of Seyval blanc wine aged by three different wood treatments, on a 9-point hedonic scale. *(No significant differences within rows)*

Wood Treatment	Aroma	Taste
Oak Chips	6.5	6.8
Used Barrels	7.0	7.0
New Barrels	6.8	6.7

Conclusion: In 1988, the Seyval blanc researchers theorized that any sensory differences within the columns above were likely the result of the greater oxygen exposure during aging in new barrels, and concluded that the potential for using oak chips seems to have promise during wine aging in used barrels. (2)
In 2008, Australian researchers concluded that wood chips provided faster extraction of some oak compounds, such as vanillin, compared to the slow and sustained extraction evidenced in both used and new barrels. The authors believe that chips are a good option for short-term aging, but that overall wine quality is better with new barrels.(1)

So, oak chips or barrels?

Resource Benefits: include lower long-term financial costs, greater protection against oxygen exposure, better utilization of cellar space, and smaller evaporative losses.

Chemical composition: the main differences in chemical composition among the wood-treated wines were increases in volatile acidity and decreases in pH for the new and used-barrel wines, as compared to wines using oak chips only. (per Table 1) These differences were below the detectable sensory threshold.

Sensory aspects:
a) taste panel members were able to distinguish between Seyval blanc wines aged in stainless steel tanks containing American oak chips versus those aged in new American oak barrels;
b) wines aged in used barrels with phenolic extraction due to oak chips were not distinguished from similar wines aged in new barrels. (per Table 2)

Depending on the style of wine to be made, the benefits of using oak chips may far outweigh any costs, whether resource, sensory, or chemical.

1. **Bautista-Ortín, A. L., A. Cano-López, M. Pardo-Mínguez,, J. López-Roca, F., and E. Gómez-Plaza.** 2008. 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. Australian Journal of Grape and Wine Research. **14:**63-70.
2. **Wilker, K. L., and J. F. Gallander.** 1988. Comparison of Seyval blanc Wine Aged in Barrels and Stainless Steel Tanks with Oak Chips. Am. J. Enol. Vitic. **39:**38-43.

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