A wine barrel of laughs

[3 décembre 2007]

In winemaking, one of the key components for the vintner to consider is selection of the oak barrels that are used to store the wine. The quality of the oak has a profound effect on the final flavour and aroma characteristics and is almost as important as the grape itself. Choosing the best oak for a particular wine is not easy because there is more than one factor to consider.

First of all, a vintner will try and stick to oak harvested from the same forest that has given him/her good wines in the past. However, this does not always succeed, because each oak tree is different, depending on its location in the forest and the growing conditions. Furthermore, the wood is split into staves and stacked for up to three years before being made into barrels, so it is likely that wood from several trees is mixed during construction.

But a second factor that affects the final oak quality even more is the heat treatment it receives. The oak staves are toasted over burning wood in a process demanding the cooper's best judgement to deliver the requested quality - light, medium, or heavy toast. This process has a major influence on the wood’s aromatic profile and is governed by the toasting time and temperature and the moisture content of the wood. Toasting also softens the staves so that they can be bent for barrel making.

While toasting is an integral part of winemaking, it also has some unwanted side effects. In particular, it has the potential to produce toxic chemicals such as PAHs and dioxins that could leach from the barrels into the wine. So, as part of a program assessing all of the risks associated with manufacturing barrels for winemaking, two French scientists have measured the levels of PAHs in toasted oak wood and in wine stored in toasted oak barrels.

To begin with, Pascal Chatonnet and Julien Escobessa from Laboratoires Excell analysed oak staves at various stages of processing. The PAHs were Soxhlet extracted from ground samples using the PAH fluorene-d10 as internal standard. The extract was reconstituted in acetone for analysis by GC/MS with electron ionisation, using specific groups of ions to detect and quantify the compounds. The detection limits ranged from 0.5-4 ng/g.

Staves that had been stored for 9-24 months in the open in a wood lot then in a final conditioning unit contained surprisingly high PAH concentrations, totalling 485.5 ng/g. However, subsequent drying in a ventilated atmosphere reduced the total levels by more than 50%, indicating that they were derived from superficial contamination, probably from the exhaust from forklift trucks.

Toasting had an effect on PAH levels. The volatile compounds, such as fluorene and phenanthrene, as well as some less volatile congeners like the carcinogenic
benzanthracene, tended to be driven out of the wood. Conversely, the concentrations of the high-molecular-weight PAHs in the staves rose. The increases were greater for staves that were positioned closer to the fire in the toasted stack. Encouragingly, the amounts of benzo[a]pyrene, which is one of the most toxic PAHs, were small, rising to only 3 ng/g in toasted wood placed 3-6 mm below the surface of the stack.

Next, the team analysed the PAH content of wines that had been stored for 12 months in toasted oak barrels. The total levels increased by a factor of 2-8 compared with those that had been aged in inert stainless steel containers. More intense toasting resulted in greater amounts of PAHs, although the absolute concentrations were still deemed to be relatively low. The total PAHs were less than 200 ng/L and the carcinogenic PAH content was less than 10 ng/L.

Barrels that were re-used for a second year still leached significant amounts of PAHs into the wine, due to their slow migration properties. Only in the third year did levels reduce appreciably, falling by more than 50%.

The researchers compared the overall PAH levels with those published for foods and beverages. Assuming that this was a typical wine and the average consumption is 50 L wine/person/year, they concluded that the PAH content of wine represented just 0.5-2.5% of the estimated minimum average daily dietary intake. So, PAHs in wine does not constitute a major public health hazard.

Provided that oak toasting takes place under the traditional conditions used for the wood in this study, and at around 200 °C, the wine will remain safe for public consumption.

Related Links:

- Laboratoire Excell
- *Journal of Agricultural and Food Chemistry*
  (Article in Press): "Impact of toasting oak barrels on the presence of polycyclic aromatic hydrocarbons in wine"

**Article by Steve Down**

The views represented in this article are solely those of the author and do not necessarily represent those of John Wiley and Sons, Ltd.