PHENOLIC PROFILE OF SEASONED CHERRY HEARTWOOD STAVES

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Introduction

- During aging in presence of wood, beverages undergo a series of processes that cause important changes in aroma, color, taste and astringency because of the interaction between compounds present in the wood and beverages. Although oak heartwood is the most used material in cooperage, other species such as chestnut, cherry, acacia and mulberry can be also considered. Also, in order to minimize losses in volume of beverages during aging process in wood barrels, cheaper non-oak wood alternative to barrel products like shavings or staves can be used.

Materials and methods

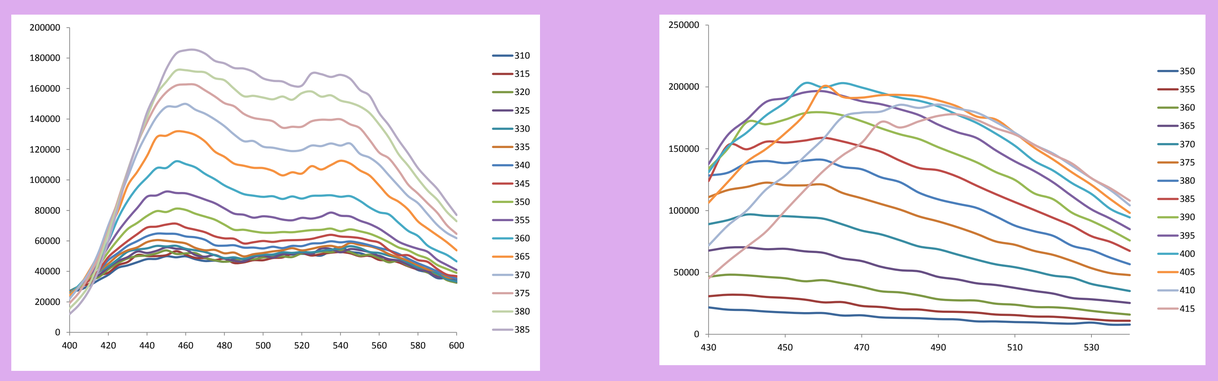
- Seasoned cherry staves originating from Serbia was characterized by HPLC-MS and spectrofluorimetry. The staves were seasoned in the open air at cooperage industry VBX-SRL. D.O.O. from Kraljevo, Central Serbia.
- The staves were crushed in a mill for wood, and extraction of obtained sawdust was carried out by procedure reproducing the conditions of spirits maturation.
- The separation, determination, and quantification of individual polyphenols were performed using a Dionex Ultimate 3000 UHPLC system with a diode array detector (DAD) coupled to TSQ Quantum Access Max triple-quadrupole mass spectrometer (ThermoFisher Scientific, Basel, Switzerland). The gradient elution was performed at 40 °C on a Syncronis C18 column, and the detection wavelengths were 254 and 280 nm.

Figure 1. Cherry wood sawdust

- The fluorescence spectra of the wood and wood extract samples were recorded using an Fl3-221 P spectrofluorometer (JobinYvon, Horiba, France), equipped with a 450W Xe lamp and a photomultiplier tube. A series of emission spectra for different excitation wavelengths in a wavelength range was performed, in order to determine the number and emission profiles of components, by using advanced statistical methods.

Results and discussion

- In cherry wood extract were identified 27 out of 37 compounds (Table 1). One can note that cherry wood originating from Serbia was rich in all investigated class of polyphenols except stilbenes, which were not found there. The most abundant investigated compound was taxifolin. Beside that, high amounts of pinocembrin, naringenin, chrysin, apigenin, quercetin, kaempferol, ellagic acid, genistein were also found, whose concentration exceeded 10 mg/L.
- The cherry wood has two maxima, at 455 nm and at 540 nm (Figure 2 (a)), which probably comes from flavonoids and lignin. The spectral shape of cherry wood extract is simpler than in wood samples and it has only one maximum at 455 nm. (Figure 2 (b)), which may be addressed to the lower number of fluorophores (absence of lignin) present in the extract comparing with wood. The wood extracts contain compounds, i.e. phenolic compounds produced in a process of lignin decomposition, which are responsible for the emission maxima in the mentioned wavelength range.



(a) (b)

Figure 2. Fluorescence emission spectra of cherry wood (a) and cherry wood extract (b), measured for a series of excitation wavelengths, indicated by different color lines on the graphs.

Table 1. Phenolic profile of cherry wood extract

Phenolic compound	mg/L
Phenolic acids	
Gallic_acid	-
Protocatechuic_acid	7.56
5-O-Caffeoylquinic_acid	-
p-Hydroxybenzoic_acid	4.7
p-Coumaric_acid	2.04
Ferulic_acid	0.73
Ellagic acid	24.34
Caffeic_acid	0.24
Flavonols	
Rutin	0.03
Quercetin_3-O-galactoside_(Hyperoside)	0.05
Isorhamnetin_3-O-glucoside	-
Kaempferol_7-O-glucoside	-
Quercetin	17.01
Kaempferol	12.74
Isorhamnetin	-
Galangin	4.93
Kaempferide	0.78
Flavones	
Vitexin	6.08
Luteolin	5.09
Chrysin	65.1
Apigenin	21.27
Acacetin	5.59
Genkwanin	5.46
Flavanones	
Naringenin	37.2
Naringin	-
Eriodictyol	8.14
Pinocembrin	168.29
Flavanonols	
Taxifolin	768.7
Isoflavones	
Daidzein	0.07
Genistein	12.47
Stilbenoids	
Resveratrol	-
Oxyresveratrol	-
Pterostilbene	-
Coumarins	
Aesculin	-
Aesculetin	9.3
Other	
Coniferyl_aldehyde	0.35
Phloretin	1.56