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Quantification of coumarins in wine spirit aged by different technologies using chestnut wood

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Ageing in wood is a key stage of the wine spirit (WS) production process since it encompasses several physicochemical phenomena involving the distillate and the wood.[1] It contributes to the beverage's enrichment in wood phenolic compounds, which are positively correlated with its sensorial properties, such as colour, some aroma attributes and bitterness.[2] Such phenomena are fundamental for the quality of the aged WS and depend on the technology applied and the kind of wood used.[2,3] Ageing technologies have been studied, namely the application of wood fragments combined with micro-oxygenation (MOX) in a attempt to simulate the physical and chemical changes occurring in a wooden barrel; the results attained by this alternative technology showed that it is possible to accelerate the ageing process in comparison with traditional process, enabling to obtain higher quality aged WS.[4,5] The main wood species used for manufacture of barrels is oak, but in particular cases the chestnut wood has gained prominence.[2,6,7]

Phenolic composition in aged WS has been identified and quantified using HPLC method, being the phenolic acids and phenolic aldehydes the most abundant compounds, and coumarins are minority.[2,3,4] In addition, to the best of our knowledge, few works reported the coumarins content in aged WS by the traditional technology[8,9] and none addressed their presence in aged WS by the alternative one. Coumarins are secondary metabolites originating from the phenylpropanoid pathway *via* t-cinnamic acid, and their presence in the aged WS have been associated with increase of bitterness perception.[9] Thus, the main aim of the present study was to quantify umbelliferone and scopoletin in WS aged with chestnut wood using different ageing technologies (MOX combined with wood staves *vs* wooden barrels).

For this purpose, a wine distillate produced by Adega Cooperativa da Lourinhã (Lourinhã, Portugal) was aged with Portuguese chestnut wood (*Castanea sativa* Mill.) staves, in 50 L demijohns, comprising different MOX modalities (O15, O30 and O60) and one modality with nitrogen application (N; control), and by the traditional technology using chestnut barrels (T), with two replicates, during 12 months.[4] The aged WSs were sampled at 8, 21, 60, 180, 270 and 365 days of ageing,[4] and assessed in terms of umbelliferone and scopoletin contents by HPLC-UV-VIS coupled to a fluorescence detector.[8] Two-way ANOVA was performed to examine the technology and ageing time effects on both coumarins' contents.

Overall, the results revealed that ageing time had a significant influence on umbelliferone and scopoletin contents in the aged WS. The umbelliferone content increased gradual and significantly from 8 to 365 days; a non-significant difference was only found between 180 and 270 days. The scopoletin content also increased over time but in a less significant way. Concerning the ageing technologies, the aged WS resulting from MOX had significantly higher content of umbelliferone [4.07 µg/L (O15); 3.64 µg/L (O30) and 3.92 µg/L (O60)] than those aged in wooden barrels [2.95 µg/L (T)] and the control [3.13 µg/L (N)]. In contrast, the scopoletin content was significantly higher in T (28.05 µg/L) and N (23.37 µg/L) than in O15 (9.58 µg/L), O60 (12.83 µg/L) and O30 (19.18 µg/L). The higher level of oxygen applied (O60) seems to have favoured the balance between additive phenomena and subtractive phenomena involving umbelliferone, but in the case of scopoletin, it may have contributed to the displacement of this balance to the subtractive ones. Besides, the lower level of scopoletin induced by the O15 technology may be positive from the aged WS quality perspective, given the potential contribution of this coumarin to bitterness perception.

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