Volatile Characterisation

A total of fifty-six volatile compounds were identified and quantified, with concentrations ranging from 1 µg/L to more than 50,000 µg/L, with a selection of some of the most representative shown in Table 1.

Alcohols: cis-3-hexenol was present at levels above sensory detection thresholds, suggesting a role in the aroma, contributing 'green', 'grass' and 'leafy' notes. 3-methyl-1-butanol was present at high odour activity values that can contribute to 'fatty', 'alcohol' aroma notes. 2-phenethyl alcohol and 2-methyl-4-pentyloxyalcohol also show OAV > 1, which may contribute to 'rose-like' and 'spicy' aroma nuances in wines.

Esters: The ester group was the most significant contributor among the wine samples. 2-phenethyl acetate, ethyl decanoate, ethyl octanoate, ethyl hexanoate and isovalyl acetate all showed high odour activity values, suggesting an active contribution to the sensory properties of these Verdelho wines. 2-phenethyl alcohol has been described as an enhancer for 'floral' and 'sweet-like' notes in young white wines, especially if associated with compounds with 'sweet' aroma such as isovalyl acetate.

Acids: hexanoic, octanoic and decanoic acid detected at concentrations above their sensory threshold level with OAV > 5, likely having an impact in the aroma. Isobutyric, isovaleric and 2-methylbutyric acid also showed OAV > 1, with concentrations that differed significantly between samples, which may lead to differences in their contribution to the 'cheese', 'fatty' notes in the wines aroma.

Monoterpenes: The total amount of measured free monoterpenes (59.4-173 µg/L) confirms Verdelho as a neutral variety. α-pinene and linalool were the most abundant, with only 3% showing significant differences between samples, and an OAV > 1, showing a potential discriminatory sensory power, contributing to the 'floral' aroma of the wines. In these samples, the total monoterpenes content were found predominantly in their free forms (Fig. 1).

Sensory Characterisation

Verdelho wines from the Granite Belt region were characterised by a 'brilliant/clean' appearance and 'flavour intensity', in which 'creativity' and 'persistance' were dominant descriptors. Aroma was characterised as intense with 'tree-fruit' and 'pungency' as dominant descriptors, together with 'herbsaceous' and 'rockmelons' notes.

VD2 showed a high level of the 'floral/perfumed' attribute, likely due to higher levels of potent odorants such as 2-phenethyl alcohol and 2-phenethyl acetate (data not shown). VD3 showed the largest 'estery' flavour attribute, supported by high levels of isovalyl acetate, ethyl-3-hydroxybutyrate, and diethyl malate (data not shown) contributing to 'banana', 'fruity', 'grape-like', 'apple skin like', 'sugar' and 'sweet' aromas. VD2 and VD3 also showed high scores for 'heatness', which may be linked to the higher level of alcohol contents for these samples. High scores for 'floral/perfumed' and 'tropical fruit' attributes were found for VD3 and VDS, with the latter being characterised by the highest values of medium chain fatty acid esters. VDS also showed the most 'golden' colour, 'tropical fruit' and 'passionfruit' aromas, together with the highest 'sweetness' and lowest 'hot' attributes. VD6 was characterised by the highest level of the 'sulphides' note, together with a high level of the 'golden' appearance.

Conclusions

In this work, the combination of SPE techniques with GC-MS, together with descriptive sensory analysis has successfully allowed a complete analysis of the volatile compounds and sensory characterisation for the Verdelho wines produced in the Granite Belt region of the Australian state of Queensland, for the first time revealing their complex chemical profile and rich aromatic composition.