Characterization of the Aroma Profile of Madeira Wine by Sorptive Extraction Techniques

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The characterization of the aroma profile of thirty-three samples of Madeira wine from five monovarieties (*Sercial*, *Verdelho*, *Boal*, *Malvasia* and *Tinta Negra Mole*) having different type and categories is presented, using solid phase microextraction and stir bar sorptive extraction techniques (SPME and SBSE) followed by capillary gas chromatography and mass spectrometry detection (GC-MS).

Headspace SPME/GC-MS provided effectiveness to identify the major constituents of the aroma profile of Madeira wine, where no remarkable differences occur among the samples studied. The volatile compounds are mainly constituted by ethyl octanoate (11.3-256.9 μgL^{-1}), ethyl decanoate (21.5-210.5 μgL^{-1}), ethyl decenoate (0.1-112.8 μgL^{-1}), diethyl succinate (0.9-65.6 μgL^{-1}), ethyl dodecanoate (1.2-6.5 μgL^{-1}), ethyl nonanoate (0.6-5.2 μgL^{-1}), ethyl hexanoate (0.2-3.7 μgL^{-1}) and isoamyl octanoate (0-2.2 μgL^{-1}). C_{13} norisoprenoids such as vitispirane (0.9-7.0 μgL^{-1}) and 1,1,6-trimethyl 1,2-dihydro naphthalene (0.7-12.5 μgL^{-1}), as well as phenyl ethanol (0-8.1 μgL^{-1}), were also found in Madeira wine samples.

The powerful capabilities of SBSE followed thermal desorption and GC-MS analysis allowed higher ability for profiling traces and ultra traces of compounds in Madeira wine samples, including esters (80.7-89.7 %), carboxylic acids (1.6-4.2

%), alcohols (3.5-8.2 %), aldehydes (0.9-3.7 %), pyrans (0.2-1.7 %), lactones (< 3 %), monoterpenes (0.1-1.4 %), sesquiterpenes (0.1-0.8 %) and C_{13} norisoprenoids (1.7-6.5 %), which some of them play a remarkable impact on the aroma complexity. C_{13} norisoprenoids in particular, seem to play an important role on Madeira wine bouquet since presenting very low sensorial threshold limits. Excellent correlation between Madeira wine ageing and the abundance of *cis*-oak lactone was attained showing to be an important chemical descriptor to characterize reserves and Vintages as well as a contributor to wine flavour.

The differentiation between reserves, dry/medium dry and sweet/medium sweet young wines could be well established by means of chemometric analysis, using particular aroma compounds such as diethyl succinate, *cis*-oak lactone and ethyl octanoate as discriminating variables.

References

R.F. Alves, A.M.D. Nascimento, J.M.F. Nogueira, *Anal. Chim. Acta* 2005, 546, 11-21.