THE INFLUENCE OF THE HEATING PROCESS AND AGING IN THE VOLATILE COMPOSITION OF *TINTA NEGRA MOLE* RED WINES

Rosa Perestrelo, José C. Marques, José S. Câmara

Madeira Research Chemistry Center, Department of Chemistry, Madeira University, Campus Universitário da Penteada, 9000-390 Funchal. Portugal; e-mail: jsc@uma.pt

The wine volatile composition comprise a structurally diverse class of molecules and the aromatic complexity of the wines is the product of a biochemical and technological sequence (grape desteming, crushing and pressing technology) and is decisively influenced by several factors such as grape variety, climate conditions, the type of winemaking technology and alcoholic fermentation procedure. The ability to determine each individual component provided one approach to optimise the operational conditions, mainly, the winemaking technologies. However this is a challange for the scientists, owing to the complexity and diversity of such compounds in wines.

Madeira wine is produced following some traditional and very specific processes that includes: the fermentation interruption by addition of natural grape spirit; and a baking process known as "*estufagem*" during which the wine is kept at rather higher temperatures (45-50ºC) for as long as 3 month. After this treatment, the wine is allowed to undergo a normal maturation process in oak casks for a minimum period of 3 years.

The main aims of the present are to study the aroma profile of different types of TNM red wines (TNM-dry; TNM-medium dry; TNM-sweet and TNM-medium sweet) and by other hand evaluate the influence of the heating process, ("*estufagem*") in the volatile composition of TNM wines.

The TNM red wines used in this study were made from the 2003 harvest grapes grow in the Portuguese RAM Appellation. The wine samples were taken directly from the cellars in October 2004. For the "estufagem" studies the wines are kept in 200 L of stainless steel tanks at 30, 45 and 55ºC during 1 and 4 month.

Wine samples preparation includes a dichloromethane ELL extraction followed by concentration under a stream of pure N_2 to 500 µl. Extracts were analysed using a Varian gas chromatograph equipped with an Varian Saturn 3 mass selective detector and Saturn GC/MS workstation software. Identification was achieved by comparisons with mass spectra obtained from the sample with those from the pure standards and by comparison with the Kovats indexes and the mass spectra present in the NIST MS library database. The method used allows a good recovery of volatile compounds and a rapid and easy quantification, with high sensitivity and repeatability, good linearity, low detection and quantification limits. To detect statistically significant differences between the different TNM red wine types and during the baking process, the mean values obtained from different groups of compounds were compared by one-way ANOVA assuming that there were significant differences between mean values when statistical composition gave $P < 0,05$. Multivariate analysis (PCA and SLDA) was used in order to study the main sources of variability present in the data sets and to establish relations between samples (objects) and volatile compounds (variables).

Higher alcohols (aliphatic and aromatic) are quantitatively the largest group of the volatile compounds in the TNM red wine types. The ethyl esters and fatty acids formed enzymatically during the fermentation process constitute important groups of aroma compounds that contribute with fruity and cheese/fatty notes to the wine sensory properties, respectively. A significant variation of several volatile compounds during "estufagem" was observed. The results show a great decrease from ethyl esters of fatty acids (C_6 to C_{16}) contrary to the high increase from ethyl esters of fix acids such as ethyl lactate and diethyl succinate. Also, it was observed that during the heating process, there is a strong correlation between sugar derivatives: furfural, 5-methylfurfural, 5-hydroxymethylfurfural and 5-ethoxymethylfurfura and the "estufagem" temperature.