

Identification of Compounds associated with the aroma characteristic of spoiled white wines

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INTRODUCTION

The "oxidative degradation" of white wines rapidly leads to a loss of their sensorial qualities. The presence of "off-flavours" has been attributed to compounds such as methional, eugenol, sotolon and 2,3,5-trimethyl-1,3-dioxolane (1). It has been shown that cyclic acetals are closely related to the progressive formation of ethanal and sotolon, during "oxidative aging" of Port wines (2), the 1,1,6-trimethyl-1,2-dihydropentalene (TDN), a substance responsible for the "kerosene" aromas typical of old wines from the Riesling variety has been reported as increasing in concentration during "accelerated" oxidation (3). In the present study sniffing analysis is employed to screen for the presence of aromatic zones with odors related with descriptors characteristic of "precoocious aging". The "Aroma Extract Dilution Analysis" technique (4), has been used, with great success in the identification of the substances responsible for the typical aromas of various foodstuffs (5,6). Therefore the application of this procedure to both normal and to spoiled white wines permits the comparison of the respective aromagrams enabling the selection of the substances of greatest interest for identification as responsible for undesirable aromas in study.

MATERIALS AND METHODS

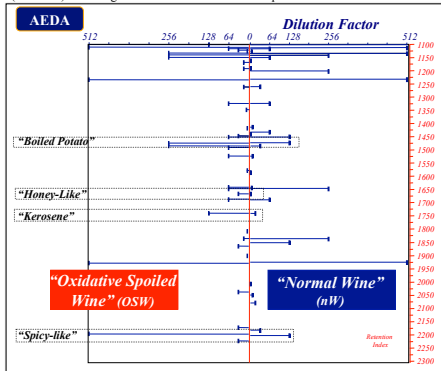
- **Wine material** - The wines used in this study were, dry white wines, of the same commercial brand produced in the Dão region (Portugal) from nine different vintages (1991-2001) following standard winemaking procedures, without wood contact.
- **Sensory studies Descriptors selection:** The sensory panel consisted of 12 trained testers. Tests were performed in tulip glasses containing 30 mL of wine, the descriptor selection being based on a white wine that was in several sessions unanimously considered as "oxidative spoiled" ("Oxidation Spoiled Wine" - OSW). The procedure used to select the most important descriptors was based on AFNOR NFV-09-021. **Similarity testing** : The identified aroma-active compounds were then added to unspoiled wine, which were then compared to the OSW and similarities (0-10) ranked according. **Organic extract Selection** : Different organic solvents were used to obtain extracts of the OSW. Similarity tests were performed between the aroma of the extracts and that of wine (7).
- **Gas Chromatography / Olfactometry / Mass spectrometry:** Dichloromethane wine extracts and chromatographic conditions are described in 6 and 8.

RESULTS AND DISCUSSION

- The identification of the descriptors on the "OSW":
 - Using the AFNOR 09-021 procedure it was selected the following adjectives "honey-like", "farm-feed", "hay" and "woody-like" (8, 9).

GC/Olfactometry analysis of a dichloromethane extract of a "OSW" :

- Three aromatic zones were selected "boiled-potato" (RI=1474), "honey-like" (RI=1667) and "kerosene", (RI=1742) has being related with the former descriptors.



- A recombinant analysis was performed using methional (20 ug/L), phenylacetaldehyde (100 ug/L) and sotolon (20 ug/L), concentrations founded in the OSW. The molecules were added separately or together to a non-spoiled wine (nW). The panel was asked to rate the degree of similarity (SV) between each sample and the OSW, on a scale of 0 (no similarity) to 10 (equal).

- When the three compounds were added simultaneously to the wine the highest similarity value of was found (5.4).
- All combinations including the presence of methional were rated with the highest similarity values.
- The simple addition of methional was responsible for 3.6 of similarity.

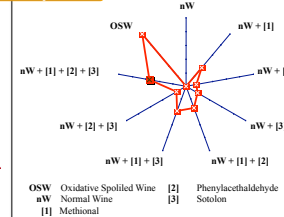
GC-O

Spoiled Wine	RI	Normal Wine	Spoiled Wine	RI	Normal Wine
"totten-egg"	1067		fresh grass	1524	"potato-like"
straw	1085		almond	1554	
	1087	glue	plum	1562	
	1095		cucumber	1578	
strawberry	1100	strawberry		1586	cherry
strawberry	1111	strawberry	burnt	1643	burned
butter	1114	butter	cherry	1648	cherry
white glue	1121		"honey-like"	1667	"honey-like"
solvent	1126	solvent	cherry	1690	cherry
fruit	1132	fruit	"kerosene"	1742	"kerosene"
fruit	1148	fruit	honey	1818	
plant	1153		"cooked apple"	1838	"cooked apple"
cereals	1167	cereals	plum	1866	"sulfur compound-like"
grass	1191	grass	1868		
solvent	1201	solvent	"sulfur compound-like"	1904	
"totten-feed"	1233	"totten-feed"	rye	1930	ryes
fruit	1260	fruit	"sulfur compound-like"	1972	
"hot bread"	1325	"hot bread"	fruit	2016	fresh
"sliced cookies"	1348		spice	2040	
beer	1418	beer	2052		caramel
1423	"sulfur compound-like"	volatile phenol	2106		
toast	1447	toast	sulfur compound	2152	
vinegar	1451	vinegar	volatile phenol	2176	volatile phenol
"boiled potato"	1474	"boiled potato"	"spicy-like"	2199	"spicy-like"
fruit	1485	fruit	2205		volatile phenol
plant	1493		2228		

- AEDA analysis of a "spoiled" and a "normal" wine :
 - Three zones, was significantly greater in the "spoiled" wine.
 - The highest dilution factor observed (FD=512) corresponded to "spice-like" aroma with a retention index of 2186.

- Using a GC/MS it was possible to identify the corresponding molecules :
 - Methional (RI=1474), phenylacetaldehyde (RI=1667), TDN (RI=1742), and Sotolon (RI=2199).

Similarity Value



CONCLUSION

- ✓ The identification of the most important descriptors related with the "oxidation spoiled wine", "OSW" was performed by a trained sensory panel. The terms selected were "honey-like", "farm-feed", "hay" and "woody-like".
- ✓ By GC/Olfactometry analysis of a OSW it was possible to determine three aromatic zones related with these descriptors. The AEDA technique allowed the identification of some molecules present in aromatic zones : methional, phenylacetaldehyde, 1,1,6-trimethyl-1,2-dihydropentalene (TDN) and 4,5-dimethyl-3-hydroxy-2(5H)-furanone (sotolon).
- ✓ The recombinant analysis of three of these compounds (methional, phenylacetaldehyde and sotolon), has shown the aromatic of these substances on the "precoocious ageing" of the white wine.
- ✓ Methional has the most aromatic influence in spoiled wine, followed by sotolon and phenylacetaldehyde, respectively.

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