

STUDIES ON THE AROMA OF SAUVIGNON WINE

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Abstract

The Sauvignon variety is part of the grape varieties semi-aromatic; the flavor is not given by the terpenes, as the aromatic varieties (muscat) but is given by other compounds, found in grapes under the form of precursors flavor, odorless thiols and after the alcoholic fermentation are converted in corresponding aromatic thiols. The volatile compounds that participate at the Sauvignon flavor, according to some authors are mercaptans and especially the 4-mercapto-4-methylpentan-2-one and after others is methoxypyrazine, compound with a decisive role in the variety flavor. There were analyzed three Sauvignon wines from the wine region Dealu Mare, vintage from 2007, 2008 and 2011. The wines were analyzed physico-chemical and analytical technique of GC/MS. In the Sauvignon case of the 2011 year there was identified and determined quantitatively with the GC/MS method, three compounds from the mercaptans group with role in the Sauvignon aroma: 4-mercapto-4-methylpentan-2-one, 3-mercaptohexan-1-ol and 3-mercaptohexyl acetate. The results led to the identification and dosing of seventeen volatile compounds. In the highest concentration was found phenyl-2-ethanol, made with rose flower scent. From the esters prevail the 2-hydroxy-ethyl propanoate and ethyl acetate. Regarding the mercaptans the results show that they have an important role in the flavor of Sauvignon, the determined concentrations are greater than their threshold of perception.

Keywords: 4-mercapto-4-methylpentan-2-one, GC/MS method, Sauvignon flavor

INTRODUCTION

The *Sauvignon* is part of the *Vitis vinifera* varieties and makes part of obtaining a higher semiaromatic wine, this variety is one of the most demanded in the international trade with wine.

The *Sauvignon* is originally from France (Sauternes) and was introduced in our country, like many other wines, after the phylloxera invasion (twentieth century).

The *Sauvignon* wines are semiaromatic of a outstanding quality, balanced, smooth, with plenty personality. Their flavor is appreciated by tasters as suave, delicate, with a aroma of citrus, flowers of vine etc. When the ecopedoclimatic conditions are met the *Sauvignon* wine can be an exceptionally wine and rarely equaled.

About the *Sauvignon* flavor there are many research and opinions. According to some authors the most important flavor compounds that participate at the *Sauvignon* flavor are methoxypyrazine (Allen M. et al, 1991) and volatile thiols (mercaptans) that are part of different fruit flavor (Chandary S. et al., 1984;

Guth H, 1997) like: grapefruit, passion fruit, guava, pomelo, black currants.

Thiols are found in grapes as precursor form, odorless, bound of amino acids. They became flavored only after alcoholic fermentation.

The most studied mercaptans are: 4-mercapto-4-methylpentan-2-one (broom flavor, tree bark), (Chandary S. et al., 1984, Guth H, 1997), 3-mercapto-3-methylbutan-1-ol (flavor of leeks cooked), 3-mercaptohexan-1-ol (pomelo, passion fruit, lemon), 3-mercaptohexyl acetate (passion fruit) and 4-mercapto-4-methylpentan-2-ol (flavored with lemon, pomelo, passion fruit) (Guth H, 1997, Tranchant J. et al., 1995). Mercaptans are found in nature in different concentrations, their sensory perception is related to the concentration. Between thiols, 4-mercapto-4-methylpentan-2-one has a very low perception threshold and is essential in *Sauvignon* wine flavour.

Compounds as 4-mercapto-4-methylpentan-2-one, 3-mercaptohexan-1-ol are also part of other wines like: *Gewurztraminer* (*Traminer roz*), *Colombard*, *Chenin Blanc* etc.

However, it seems that to the distinct flavor of *Sauvignon* participate and other volatile

compounds: esters, aliphatic alcohols, aromatic alcohols, terpenes etc.

MATERIALS AND METHODS

Wines Analyzed. Analyses were carried out on Romanian *Sauvignon* wines from the wine region *Dealul Mare*, vintage from 2007, 2008 and 2011. *Sauvignon* wines was analyzed in terms of physico-chemical characteristics: alcoholic strength (vol% alcohol), sugar content ($g\cdot L^{-1}$), total acidity ($g\cdot L^{-1}$ sulfuric acid), total dry extract ($g\cdot L^{-1}$), acidity volatile ($mg\cdot L^{-1}$ acetic acid) and glycerol ($g\cdot L^{-1}$). All analyses were performed by the standard methods (Tardea C., 1980): ebulliometer method for alcoholic strength; titrimetric method for total acidity; distillation method *Saunier-Cazenave* for acidity volatile; *Tabarie* method for total dry extract and volumetric method for glycerol.

Specific Extraction of Volatile Compounds. *Sauvignon* wines vintage from 2007, 2008 and 2011.

200 mL of wine, placed in a conical flask, were successively extracted (3 x 20 min) at 0°C with 3 x 25 mL of freshly distilled dichloromethane and then centrifuged for 15 min. The three organic extracts were pooled, dried with anhydrous sodium sulfate and concentrated to 5 mL in a Danish concentrator (45°C), then to 1 mL under a stream of nitrogen (Baek H., 1997; Campeanu G., 2001, Serot Th, 2009; Tranchant J. et al, 1995).

Specific Extraction of Volatile Thiols. *Sauvignon* wines harvest 2011 (Tominaga T. et al., 1998).

A volume of 500 mL of wine containing 4-methoxy-2-methyl-2-mercaptobutane as an internal standard was brought to pH 7.0 with a sodium hydroxide solution and extracted with two successive additions of 100 mL of dichloromethane with magnetic stirring for 5 min; The organic phases were centrifuged for 5 min to break the emulsion and separated in a funnel; The organic phase obtained was then extracted with two additions of 20 mL of a p-hydroxymercurbenzoate solution 5 min; The two aqueous phases, from the extraction, were combined brought to pH 7.0 by addition of a 5% solution of hydrochloric acid; They were

loaded into a strongly basic anion exchange column; The volatile thiols were released from the complex thiol-p-hydroxymercurbenzoate fixed on the column by percolating for 40 min using a cysteine solution adjusted to pH 7.0; The organic phases were collected, dried on anhydrous sodium sulfate and concentrated under nitrogen flow (Tominaga T. et al., 1998). *GC/MS*. Determination of volatile aromatic compounds in wine was performed using a Hewlett Packard 5890 gas chromatograph series II coupled to a mass spectrometer Hewlett Packard 5972 series II.

Quantitative analysis of volatile compounds identified in *Sauvignon* wines vintage from 2007, 2008 and 2011 by GC/MS. 1 μ L from each extract was injected into an HP 5-MS capillary column with dimensions: 30 m x 0.25 mm x 0.25 mm (film thickness). Column temperature: 30° C for 10 min., followed by temperature gradient 10° min^{-1} up to 80° C, then gradient of 25° C/min. up to 250° C where stationed 10 minutes. Detector and injector temperatures are: 280° C and 250° C resp. Carrier gas is He, flow-0.5 $ml\ min^{-1}$. MSD conditions are: temperature 180 °C ion source, ionization energy 70 eV, mass limit of 20-400 amu, electronic multiplier voltage 1700V, scan rate 1.60 s^{-1} . Injection mode: split, opening after 60 sec, and the split flow: 20 $mL\ min^{-1}$. Quantitative determination and identification of volatile compounds based on the comparison of retention indices (RI), mass spectra and the estate of odors. Identification is based on the standard MS library Wiley (Serot Th., 2001; Visan L., 2007).

Quantitative analysis of volatile thiols identified in *Sauvignon* wines harvest 2011 by GC/MS (T. Tominaga and ot., 1998). 2 μ L from extract was injected into an HP 5-MS capillary column. The three volatile thiols were detected: 4-mercapto-4-methylpentan-2-one, 3-mercaptohexan-1-ol and 3-mercaptohexyl acetate (Tominaga T. et al., 1998).

RESULTS AND DISCUSSIONS

Chemical and organoleptic analyses of wine. The three *Sauvignon* wines from the Romanian wine region *Dealul Mare*, harvest 2007 (*Sauvignon 1*), 2008 (*Sauvignon 2*) and 2011 (*Sauvignon 3*) were analyzed chemical and

organoleptic.

Results are presented in Table 1.

At organoleptic analysis three wines were presented as high quality, semidry; the wines showed a great finesse and pleasant, discrete, but with personality. It is however noted that *Sauvignon 2* with a higher alcohol content, balanced and with a distinct flavor.

Table 1. The Main Physico-Chemical Parameters Analyzed wines

Wine	total acidity ($g \cdot L^{-1}$ sulfuric acid)	sugar content ($g \cdot L^{-1}$ sugar)	alcoholic strength (vol% alcohol)	Glycerol ($g \cdot L^{-1}$)	total dry extract ($g \cdot L^{-1}$)	Volatile acidity ($mg \cdot L^{-1}$ acetic acid)
<i>Sauvignon 1</i>	5.8	10	12.2	8	22	0.3
<i>Sauvignon 2</i>	5.4	12	13.0	10	23	0.4
<i>Sauvignon 3</i>	5.2	12	12.5	8	23	0.4

Analysis of GC/MS of wines. Identification of volatile compounds.

Esters are formed in grape fermentation process in large quantities by enzymatic esterification and in the process of maturation and aging of wine by chemical esterification.

From experience the *Sauvignon* wines is seen that the same esters are found in large quantities in all three wines, although varies from year to year: *2-hydroxy ethyl propanoate*, *ethyl acetate* and *methyl butanoate* (fig.1).

It follows that these esters participate to a greater extent in *Sauvignon* flavor. It is noteworthy that as with the esters and other volatile compound found in similar concentrations, although varies slightly

depending on the year of harvest. Of aliphatic alcohols found in highest concentrations, in all the years, *3-methyl-1-butanol* (fig.2).

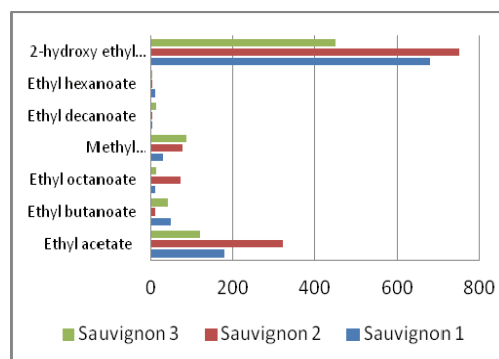


Figure 1. The main esters of a *Sauvignon* wines ($\mu g \cdot L^{-1}$)

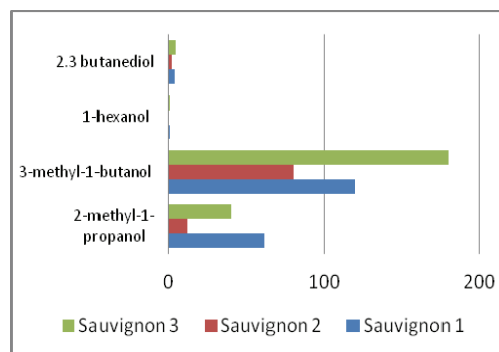


Figure 2. Concentration of aliphatic alcohols in *Sauvignon* wines ($\mu g \cdot L^{-1}$)

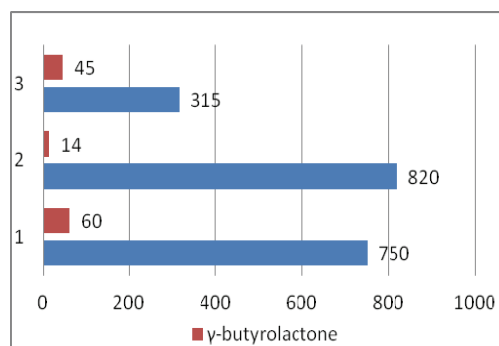


Figure 3. Concentration of aromatic alcohols and lactones in *Sauvignon* wines ($\mu g \cdot L^{-1}$)

Of terpenes *linalool* was identified only in concentrations of 1, 0.8, respectively, $1 \mu g \cdot L^{-1}$ (fig.4).

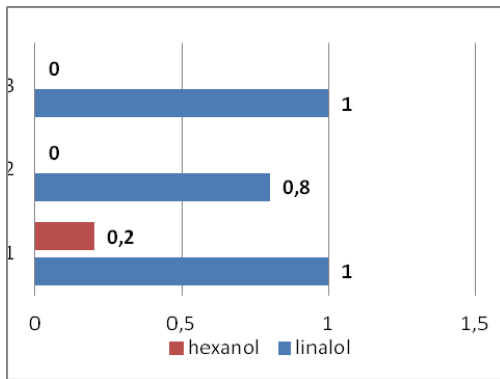


Figure 4. Concentration of terpenes in *Sauvignon* wines ($\mu\text{g}\cdot\text{L}^{-1}$)

Analysis of GC/MS of wines. Identification of volatile thiols (*Sauvignon* wines, harvest 2011)

Sauvignon wines from the harvest of 2011 were analyzed by GC/MS, after Tominaga T. method (1998), for identification and quantitative dosing of volatile thiols. The three volatile thiols were detected:

4-mercapto-4-metylpentan-2-one,
3-mercaptohexan-1-ol and *3-mercaptohexyl acetate*.

Between thiols identified the lowest threshold of perception it has *4-mercapto-4-metylpentan-2-one*, under $1 \text{ ng}\cdot\text{L}^{-1}$ (Tominaga T, 1998) (fig.5); the compound with flavored mature bark, it was identified in low concentrations near the threshold of perception of black blueberry, but also in other wines as: *Riesling*, *Gewurztraminer* etc, in low concentration.

In Romanian *Sauvignon* wine this mercaptan was identified in $23 \text{ ng}\cdot\text{L}^{-1}$ concentration, a concentration that demonstrating participation of this thiol at *Sauvignon* flavor. Also we identified *3-mercaptohexan-1-ol*, thiol with a grapefruit flavor, pomelo (fig.6) and *3-mercaptohexyl acetate*, made with passion fruit flavor and bark. The first thiol was found in concentration of $690 \text{ ng}\cdot\text{L}^{-1}$, concentration that shows the participation at the *Sauvignon* flavor. *3-mercaptohexyl acetate* (fig.7), was found in a concentration of $120 \text{ ng}\cdot\text{L}^{-1}$, well above the threshold of perception of $5 \text{ ng}\cdot\text{L}^{-1}$.

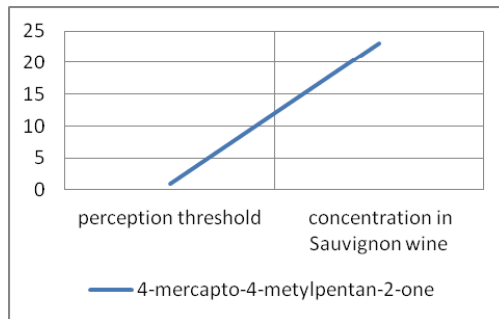


Figure 5. The threshold of Perception and concentration in *4-mercapto-4-metylpentan-2-one* from the *Sauvignon* wine ($\text{ng}\cdot\text{L}^{-1}$)

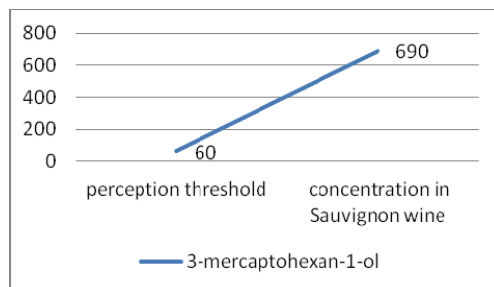


Figure 6. The threshold of Perception and concentration in *3-mercaptohexan-1-ol* from the *Sauvignon* wine ($\text{ng}\cdot\text{L}^{-1}$)

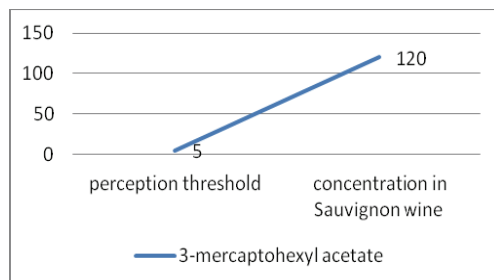


Figure 7. The threshold of Perception and concentration in *3-mercaptohexyl acetate* from the *Sauvignon* wine ($\text{ng}\cdot\text{L}^{-1}$)

CONCLUSIONS

The *Sauvignon* wines from the 2007, 2008 and 2011 harvest were assessed as high quality wines, balanced and smooth flavor, discrete, citrus and flower vines flavor. Among these wines is remarkable *Sauvignon* 2008 which was considerably more balanced and discreet flavor but with personality.

The content volatile compounds of the wine was slightly varied from year to year, but the same compounds were present in concentrations similar regardless of the year of harvest; between esters the most important in defining the specific character of *Sauvignon* were identified *2-hydroxy ethyl propanoate*, *ethyl acetate* and *methyl butanoate*; It follows that these esters participate to a greater extent in *Sauvignon* flavor. It is noteworthy that as with the esters and other volatile compound found in similar concentrations, although varies slightly depending on the year of harvest; in considerable quantities are found *3-methyl-1-butanol* and terpenes were represented by *linalool*.

Sauvignon wines from the 2011 harvest were analyzed for identification and quantitative dosing of volatile thiols. The three volatile thiols were detected: *4-mercapto-4-methylpentan-2-one*, *3-mercaptohexan-1-ol* and *3-mercaptohexyl acetate*.

Between thiols identified the lowest threshold of perception it has *4-mercapto-4-methylpentan-2-one*, under $1 \text{ ng}\cdot\text{L}^{-1}$; the compound with flavored mature bark, it was identified in low concentrations near the threshold of perception of black blueberry, but also in other wines as: *Riesling*, *Gewurztraminer* etc, in low concentration.

In romanian *Sauvignon* this mercaptan was found in concentrations of $23 \text{ ng}\cdot\text{L}^{-1}$, a concentration that demonstrates the participation of this thiol at *Sauvignon* flavor.

Also were identified *3-mercaptohexan-1-ol*, thiol with a grapefruit flavor, pomelo and *3-mercaptohexyl acetate*, made with passion fruit flavor and bark.

The first thiol was found in concentration of $690 \text{ ng}\cdot\text{L}^{-1}$, concentration that shows the participation at the *Sauvignon* flavor.

3-mercaptohexyl acetate, was found in a concentration of $120 \text{ ng}\cdot\text{L}^{-1}$, well above the threshold of perception of $5 \text{ ng}\cdot\text{L}^{-1}$.

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