DETERMINATION OF VOLATILE ACIDS IN WINES

Author: Filip Koldžić, 2nd grade of the Mathematical Gymnasium in Belgrade; filip3koldzic@gmail.com
Mentor: prof. dr Dragan Manojlović, Faculty of Chemistry, University of Belgrade
Regionalni centar za talente Beograd 2, Ustanička 64

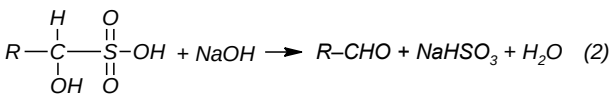
1. Introduction

Wine is agricultural product, a beverage made by alcoholic fermentation of grapes suitable for making wine. Wines contain, among other things, different kinds of acids [1]. These volatile acids are a group of organic acids which can under certain conditions be separated from wines by evaporation. They generally occur as a products of alcoholic fermentation but they can also occur subsequently in case of drink spoilage [2]. In addition to effects on organoleptic characteristics of wine, the content of volatile acids is also an indicator of its biological stability [3]. The increased content of volatile acids generally indicates wine spoilage, so legal regulations limit the content of these acids in commercial wines.
The aim of this study was to determine and compare mass concentration of volatile acids in differently stored wines of various types, red and white.

2. Materials and methods

Commercial wines from the Belgrade market were tested: dry red wine Ždrebac ("Vinoprodukt", 2016.), dry red wine Vranac ("Vinea", 2015.), dry white wine Smederevka ("Vinea", 2015.) and dry white wine Vino Bianco ("Morando", 2015.). All wines were analyzed immediately after opening and "Vinea" wines were also analyzed two weeks later. The wines were originally distilled with water vapor (by steam distillation). The distillates were titrated with standard sodium hydroxide solution (0.0938 moldm-3) with phenolphthalein as an indicator (1). Since the content of sulfur (IV)-oxide influences the amount of titrant consumed, it was necessary to make a correction to its content in wines. 1M sodium hydroxide solution (2) and diluted sulfuric acid (3) were added to the distillate to release as much sulfur dioxide as possible, and then the analyte was titrated with standard iodine solution (0.0095 moldm-3) with starch as indicator (4).

$$R\text{–}COOH + NaOH \longrightarrow R\text{–}COONa + H_2O \quad (1)$$



$$2NaHSO_3 + H_2SO_4 \longrightarrow Na_2SO_4 + 2SO_2 + 2H_2O \quad (3)$$

$$SO_2 + I_2 + 2H_2O \longrightarrow 2HI + H_2SO_4 \quad (4)$$

3. Results and discussion

Determined mass concentrations of volatile acids in analyzed wines are shown in Table 1.

Table 1. Mass concentrations of volatile acid in analysed wines

The name of the wine	Time from opening to analysis	Mass concentration [mgdm^{-3}]
Ždrebac	Immediately after	0.7313
Vino Bianco	Immediately after	0.6319
Smederevka	Immediately after	0.6410
Vranac	Immediately after	0.7124
Smederevka	2 weeks	1.0975
Vranac	2 weeks	1.1601

Based on the results in Table 1., it can be noticed that the mass concentrations of volatile acids in white wines are similar and that they are somewhat less than concentrations in red wines, regardless of the way of storing the wine. This is due to the differences in the production of white and red wines. These values are all within the range of allowed values [4]. However, significant increase occurs in wines that have been kept open for two weeks on room temperature [4]. This is most likely the result of spoilage.

4. Conclusion

It was found that the amount of volatile acids in red wines is somewhat higher than in white wines and that these values are within the allowed limits. The largest mass concentration of volatile acids was determined in red wine which was left open for two weeks on room temperature, and its values are above threshold. This is most likely due to spoilage of wine because of the inadequate conditions sample has been kept in.
Since wines and wine-based drinks are in everyday use around the world, it is necessary that they are right for human consumation. The content of volatile acids in them can serve as quality indicator.

5. Literature

[1] V. Radovanović: Tehnlogija vina, Građevinska knjiga, Beograd, 1986;

[2] M. Daničić: Tehnologija vina (praktikum), Poljoprivredni fakultet, Beograd, 1988;

[3] P. Ribereau-Gayon, Y. Glories, A. Maujean, D. Dubourdieu: The Handbook of Enology Volume 2: The Chemistry of Wine Stabilization and Treatments, John Wiley and Sons Ltd, Bordeaux, France, 2nd Edition, 2006;

[4] https://www.tehnologijahrane.com/enciklopedija/fizicko-hemijska-analiza-vina (27.01.2018)