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The influence of pressure on chemical and physical parametres of white and red wines obtained by dealcoholization method

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Abstract

Promotion of the natural wines with reduced alcohol degree for the young people, elders and for people with health problems as well as substitution of soft beverages obtained by adding of preservatives, colourants and flavoring substances is one of global winemaking trends taken by the Republic of Moldova. Wine partially dealcoholized is a product obtained by partial dealcoholization of dry wine by eliminating of the alcohol from wine using physical separation processes. The process of dealcoholization was carried in laboratory conditions using rotary evaporator. Dealcoholization process depends on different physical parameters one of which is pressure. Hence, the influence of pressure on physical and chemical parameters of obtained wines by distillation under vacuum was studied.

Keywords: Dealcoholization, wine, pressure, distillation under vacuum

1. Introduction

Expansion of consumption of natural wines with reduced alcohol content is one of the global winemaking trends, and also adopted in the Republic of Moldova. Hence wines with reduced alcohol content are in good demand with consumers. There are many reasons for this phenomenon, one of which is economic, making manufacturers to diversify the demand, by the development of new products that could interest the greatest number of consumers [1].

It has been established that increase of temperature during the cultivation of grapes leads to higher accumulation of sugars in grape berries, which in turn leads to high content of alcohol in wines. Statistical data has shown a consistent alcohol increase in Californian wines, from 12,5% to 14,8% between 1978 and 2001 and in Australian wines, alcohol content has increased from 12,4% to 14% between 1984 and 2004 as a result of global warming and new viticulture and winemaking techniques [2]. In connection with this the problem of removing a part of alcohol from wines in order to obtain more harmonious wines occurs.

It should be noted, that for the production of non-alcoholic wines or wines with low alcohol content is recommended utilization of such techniques and methods which allows removing the alcohol from wines in mild conditions, without disrupting the natural balance and naturalness of its components [3]. It is known, that such scientists as: Lisanti M. (2010) [1], Margarida Catarino (2007) [4], Meilon S. (2010, 2009) [2,5], Satit Varavuth (2009) [6], took up the problem of improving the quality of wines with low alcohol content. In the Republic of Moldova interest to such wines appeared a few years ago (2008-2009) in connection with the demand of the alcohol market

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of the Republic of Belarus, but the problem has not been solved definitive.

Currently, wines obtained in the process of dealcoholization are available for sale, but, influence of the dealcoholization process on quality and physical and chemical indices is not studied.

2. Materials and methods

Investigations on this scientific paper was conducted in the laboratory "Biotechnology and Wine Microbiology" of the Scientific and Practical Institute of Horticulture and Food Technologies and on the wine producer FCP «ASCONI» SRL Republic of Moldova.

In capacity of the subject of research white dry wine Aligote and red dry wines Merlot, white and red wines with different content of alcohol was used.

Basic chemical-physical parameters was determined using methods accepted by the modern winemaking practice. During the study some of chemical-physical parameters of obtained wines was determined using up-to-date apparatus FOSS WineScan ™ SO_2 (Denmark).

3.Results and Discussion

Pressure is very important technological factor that influences the process of dealcoholization. Wine from the chemical point of view is a complex homogeneous system, a major component of which is ethyl alcohol. However, under normal pressure, ethyl alcohol with water gives an inseparably boiling mixture and dealcoholization process in this case will be accompanied by a significant loss of water. Pressure reduction lead to decrease of alcohol boiling temperature, furthermore, the azeotropic mixture is formed and the alcohol can be eliminated from the wine. It is also worth noting that high temperatures can influence the aromatic compounds in wine, which are represented by alcohols, volatile acids, aldehydes, terpene which provide unique flavors of wines from different grape varieties.

In this paper, the influence of pressure on the dealcoholization process of white and red wines was studied. Dealcoholization process was carried out in laboratory conditions using a vacuum rotary evaporator at a constant temperature, the volume of wine and duration of the process. In order to determine the influence of pressure on the dealcoholization process in the samples of white and red dealcoholized wines, the main chemical-physical parameters were determined. Obtained results are presented in Table 1.2.

Table 1. Influence of the pressure on chemical-physical indices of dealcoholized white wines Aligote

Parameter	**Pressure, kgf/cm^2**					**Control**
	-0,6	**-0,7**	**-0,8**	**-0,9**	**-1**	
Alcohol content, % vol	11,9	11,32	11,18	10,4	9,99	12,13
Titratable acids, g/dm^3	6,2	6,3	6,3	6,4	6,6	6,2
Volatile acids g/dm^3	0,33	0,33	0,33	0,31	0,31	0,33
Residual sugars g/dm^3	1,3	1,5	1,5	1,5	1,8	1,3
pH	3,23	3,23	3,23	3,23	3,22	3,23
Tartaric acid, g/dm^3	3,5	3,6	3,6	3,6	3,7	3,5
Malic acid, g/dm^3	1,18	1,2	1,2	1,2	1,26	1,18
Lactic acid, g/dm^3	0,48	0,48	0,49	0,52	0,54	0,48
Citric acid, g/dm^3	0,27	0,28	0,28	0,29	0,30	0,27

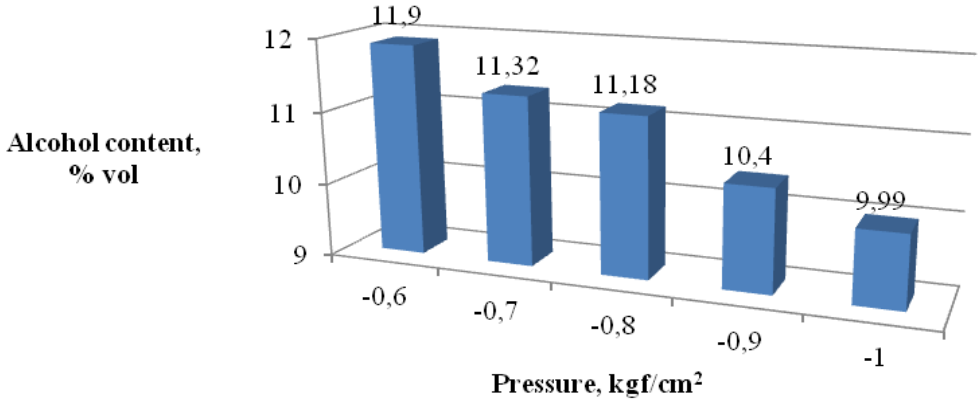

Figure 1. Influence of the pressure on alcohol content of obtained white dealcoholized wines

Table 2. Influence of the pressure on chemical-physical indices of dealcoholized red wines Merlot

Parameter	Pressure, kgf/cm²					Control
	-0,6	-0,7	-0,8	-0,9	-1	
Alcohol content, % vol	13,1	12,5	11,6	11,31	10,62	13,5
Titratable acids, g/dm³	5,9	6,1	6,2	6,3	6,5	5,9
Volatile acids g/dm³	0,36	0,36	0,36	0,36	0,34	0,36
Residual sugars g/dm³	2,5	2,6	2,8	2,8	2,9	2,5
pH	3,3	3,3	3,3	3,3	3,3	3,3
Tartaric acid, g/dm³	2,7	2,8	2,9	2,9	3,1	2,7
Malic acid, g/dm³	1,84	1,86	1,88	1,92	1,94	1,84
Lactic acid, g/dm³	0,61	0,63	0,63	0,67	0,69	0,61
Citric acid, g/dm³	0,22	0,22	0,24	0,24	0,25	0,22

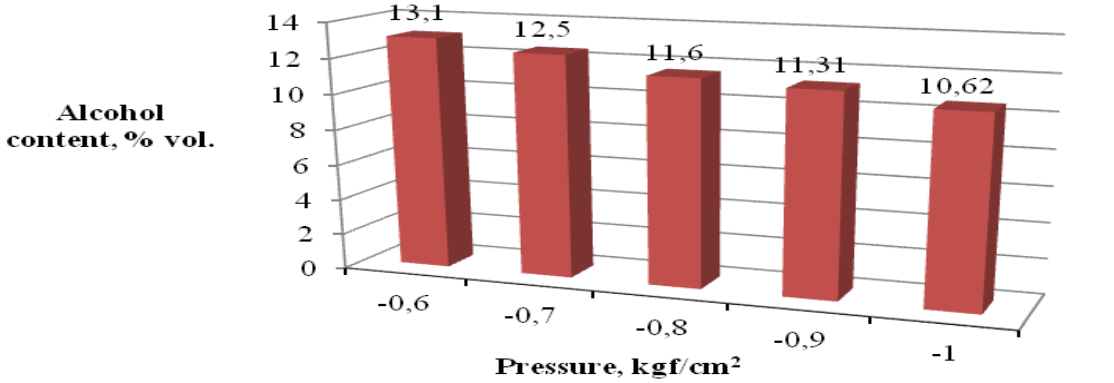

Figure 2. Influence of the pressure on alcohol content of obtained red dealcoholized wines

Table 1 presents the influence of pressure on chemical-physical indices of dealcoholized white wines. The mass concentration of titratable acids, residual sugars increases unperceivable and varies within the permissible range in obtained dealcoholized white wines. Mass concentration of volatile acids varies in range from 0,31 to 0,33 g/dm^3. The changes of one of the most important components of the chemical composition - organic acids were studied. From these results, there is a insignificant increase in the content of tartaric and malic acids from 3,5 to 3,7 g/dm^3 and 1,18 to 1,26 g/dm^3 respectively , the content of lactic acid varies from 0,48 to 0,54 g/dm^3 and citric acid- from 0,27 to 0,30 g/dm^3.

According to the analysis results it may be concluded that pressure influence significant on the rate of removal of alcohol in the process of dealcoholization. Hence pressure decrease lead to an increase of speed of the dealcoholization process. Pressure – 1 kgf/cm^2 has the greatest influence on the dealcoholization process. Thus, alcohol content has decreased only about 0,23% vol. at pressure – 0,6 kgf/cm^2 and at a pressure of -1 kgf/cm^2 alcohol content decreased by about 2,14% vol.

Red wines differ from the white wines not only in chemical composition, but also has different organoleptic characteristics. Consequently, the influence of dealcoholization process on the physico- chemical parameters of red wines may differ significantly from white wines. Table 2 presents the influence of the pressure of the process of dealcoholization on chemical physical indices of dry red wines. As in the case of white wines pressure – 1 kgf/cm^2 has the greatest influence on chemical and physical indices of obtained wines. Mass concentration of titratable acids in the obtained wines has increased and varies from 5,9 to 6,5 g/dm^3 , mass concentration of residual sugars ranges from 2,5 to 2,8 g/dm^3. Mass concentration of volatile acids and pH remained practically unchanged during the dealcoholization process.Simultaneously, in the obtained samples of red wines, an increase of organic acids is observed. Mass concentration of tartaric acid varies from 2,7 to 3,1 g/dm^3, malic acid from 1,84 to 1,94 g/dm^3, lactic acid varies from 0,61 to 0,69 g/dm^3 and citric acid varies from 0,22 to 0,25 g/dm^3.

Fig. 2 shows the influence of pressure of dealcoholization process on alcohol content in red wines. As in the case of white wines there is a relationship between alcohol removal rate and pressure quantity. Thus, when the pressure quantity constitutes – 0,6 kgf/cm^2 alcohol content in wine decreased by about 0,4 % vol. and at a pressure of -1 kgf/cm^2 alcohol content decreased of 2,88% vol. The alcohol content in the samples ranged from 13,1 to 10,62 % vol.

4. Conclusion

Some preliminary general conclusions from experimental observations can be made, it was found that the pressure has a significant influence on the rate of removal of ethanol from wine. Reducing the pressure to - 0.6 kgf/cm^2 the alcohol content has decreased of 0,2 % vol. for white wines and 0,4% vol. for red wines. Pressure reduction to -1 kgf/cm^2 leads to a significant increase in speed and reduction of alcohol content in the process of dealcoholization (2.2 % vol. for white wines and 2,9% vol. for red wines).

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Compliance with Ethics Requirements: Authors declare that they respect the journal's ethics requirements. Authors declare that they have no conflict of interest and all procedures involving human and/or animal subjects (if exists) respect the specific regulations and standards.

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