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TECHNOLOGY OF DRY WINES PRODUCTION ON THE BASE OF ALCOHOLIC CONTENT CORRECTION

253.03 TECHNOLOGY OF ALCOHOLIC AND NON-ALCOHOLIC BEVERAGES

Extended abstract of the thesis

CHISINAU, 2015

Thesis was elaborated in the laboratory "Biotechnology and Microbiology of Wine" at the Scientific and Practical Institute of Horticulture and Food Technologies (SPIHFT), in production conditions at wine factory „Nectar S" LTD.

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CONCEPTUAL ASPECTS OF RESEARCH

Relevancy and importance of the problem. The wine industry of Republic of Moldova is facing changes and technological innovation has developed new solutions, some involving grape growing techniques and oenological practices including the reduction of the alcohol content [5, 6]. Since two decades, various strategies to reduce alcohol level in wines have been considered including the improvement of viticulture or winemaking practices, the development of physical approaches and the generation of low alcohol yeasts [7]. The adoption of such technologies offers opportunities to develop new products and so to attract wide range of consumers [8, 9]. Particular significance in the process of low alcohol wine production should be given the choosing of the most acceptable method and technique. The method chosen by wine producers to moderate ethanol levels are often determined by consideration of the important factors of wine style, production volume, the level of ethanol to be removed from the product, a desire to retain natural or organic association of the product, capital outlay, operating expenses, flexibility for use of equipment and staff training requirements.

According to literature data the most appropriate methods for reduction of alcoholic content from wines are considered the physical ones (heat-based techniques, membrane technologies) [4, 5]. However, there are very few studies regarding the influence of vacuum distillation process on ethanol removal as well as on wine quality. Evaluation of physical−chemical and organoleptic changes that take place in the process of wine dealcoholization continue to present a serious scientific challenge as well as improving the quality of this category of wines requires a competent scientific and technical guidance aimed at ensuring the finished product of superior quality.

Purpose and objectives of research. The main purpose of the thesis consists in perfection of technology for production of dry wines on the base of alcoholic content correction.

Therefore, in order to achieve the main purpose of research the following specific objectives were proposed:

- Scientific substantiation of optimal regimes for alcoholic content correction in white and red dry wines using vacuum distillation method ;
- Study the influence of ethanol removal process on physical and chemical composition of obtained white and red dry wines with corrected alcoholic content;
- Study the influence of technological regimes of ethanol removal process on volatile complex of obtained white dry wines;
- Study the influence of dealcoholization process on stability of obtained dry white and red wines;
- Study the influence of ethanol correction process on sensory characteristics of obtained white and red dry wines;
- Study of different techniques for elaboration of technological regimes of alcohol content correction in dry wines;
- Elaboration and implementation the elaborated and improved technology for correction of alcoholic content in white and red dry wines in industry conditions.

Research methodology consists in performing of complex research for determining the influence of different technological factors of dealcoholization process (temperature, pressure, processing time, volume et al) on physical-chemical, biochemical and sensory indices of white and red dry wines with corrected alcoholic content. Research regarding the influence of dealcoholization process using vacuum distillation on quality of obtained wines was carried out in the laboratories of "Biotechnologies and Microbiology of Wine", "Quality testing of alcoholic beverages", in the department of Microvinification at the Scientific and Practical Institute of Horticulture and Food Technologies, at the wine factories «Asconi» LTD and «Nectar S» LTD, as well as, in the laboratory «Wine Technology» of the North Caucasian Region Research Institute of Horticulture and Viticulture from Krasnodar (Russia).

Scientific novelty and originality. Scientific novelty of the thesis consists in scientific substantiation of the method for amelioration of white and red dry wines quality by removal of the excess of ethanol. Scientific substantiation is based on the results of theoretical and experimental research, which denotes the stability of volatile complex, stability of physical-chemical characteristics as well as amelioration of the sensory properties of the wines with corrected alcoholic content.

For the first time, the scientific results regarding the changes of volatile complex of white wines was studied as well as values of losses of volatile compounds were determined in the process of vacuum distillation: reduction of esters content from 22% to 100%, higher alcohols from 8,2% to 90,7%, aromatic aldehydes and ketones from 12,9% to 70,8% and fatty acids content from 7% to 30% from initial content.

In the thesis results regarding the influence of alcohol reduction process using vacuum distillation method on the sensory perception of wines was obtained. According to obtained results, correction of alcoholic content in wines contributes the improvement of sensory characteristics of obtained white and red dry wines.

The results regarding the influence of dealcoholization process on stability of white and red wines was obtained. Obtained results demonstrate, that stability of wines depends on quality of initial wine material and extent of ethanol removed in the process of dealcoholization.

On the base of elaborated technological regimes technological scheme for correction of alcoholic content in white and red dry wines was elaborated, which provides elimination of 20% ethanol excess from wines. On the base of obtained results technological scheme for production of white and red dry wines with reduced alcoholic content using blending method was elaborated. Scientific novelty is confirmed by favourable decision of patent issuance "Method for obtaining of natural wines" (AGEPI, Nr: 8266 from 17.11.2015).

Scientific challenge solved within the thesis consists in determination and argumentation of the correlation between parameters of technological process of dealcoholization and alcoholic concentration in the final wine with corrected alcoholic content. The determined correlation is expressed by regression equations for white and red wines.

Theoretical significance. On the base of the complex study of theoretical data regarding the methods of production and improvement of the quality of wines with

low-alcohol content as well as on the base of conducted research the optimal technological regimes of dealcoholization using vacuum distillation method were elaborated. Moreover, the results concerning the influence of ethanol removal process in dependence of technological factors on volatile compounds was obtained. Obtained data allows developing of mathematical model regarding extent of influence of studied technological factors on the process of ethanol removal.

Practical significance. On the base of the complex study regarding the methods of production and amelioration of obtained wines quality after the alcoholic content correction, technologies for correction of alcoholic content in white and red dry wines using vacuum distillation method was elaborated and parameters of technological process for white and red natural wines production with corrected alcoholic content were determined. Elaborated technology was tested and implemented in production conditions at the wine factory „Nectar S" LTD. Volume of implementation consists 2000 dal of white and red dry wines. Technology for white and red dry wines with corrected alcoholic content using blending method was elaborated. According to sensory evaluation results it was established, that blending of initial wine with dealcoholized wine in proportions from 50%:50% to 70%:30% contributes the improvement of the effectiveness of process, leads to substantial reduction of operating time and amelioration of quality for wines with corrected alcoholic content.

Scientific results directed for defense of the thesis.

1. Study the influence of technological factors of the dealcoholization process on the physical-chemical and sensory indices of white and red wines with different alcoholic content;
2. Study the influence of technological factors of the dealcoholization process on the volatile complex of white dry wines;
3. Elaboration of optimal technological regimes for alcoholic content correction in dry white and red wines;
4. Study the influence of optimal technological regimes on the stability of white and red wines;
5. Elaboration and implementation in production conditions of the technology for obtaining of white and red wines on the base of alcoholic content correction.

Implementation of scientific results. Results of research was tested in production conditions at the winery "Nectar S" LTD by production of experimental batches of white and red wines Aligote and Merlot with corrected alcoholic content in the volume of 2000 dal.

Evaluation of results. Fundamental principles and results of research was discussed and reported at the proceedings of the Scientific Council of Scientific and Practical Institute of Horticulture and Food Technology (2011-2014), at International Scientific and Practical Forum «Роль экологизации и биологизации в повышении эффективности производства плодовых культур, винограда и продуктов их переработки», 2013, (Krasnodar, Russian Federation); International Scientific Symposium „Agricultura Modernă – Realizări şi Perspective" and „Horticultura modernă - Realizări şi perspective", Agrarian State University, 2013, 2015, (Chisinau, Republic of Moldova); International Scientific and Practical internet-Conference «Иннова-

ционные технологии и тенденции в развитии современного виноградарства и виноделия», 2014, (Yalta, Crimea); The 5th International Conference on Food Chemistry, Engineering & Technology", 2014, (Timisoara, Romania); International Conference "Tehnologii Moderne în Industria Alimentară -2014", Technical University of Moldova, 2014, (Chisinau, Republic of Moldova); International Scientific and Practical Conference: «Современные проблемы и тенденции развития пищевой промышленности», 2015, (Maikop, Russian Federation). Moreover, results of research was reported to the World Federation of Scientists (Switzerland) within the National Scholarship of World Federation of Scientists in the period 2013-2014 and to the Academy of Science of Moldova within the project for young scientists (2013-2014).

Volume and structure of the thesis. Thesis is structured in four chapters, first of which is literature data analysis including the current state of the problem studied in the thesis, the second chapter represents description and brief analysis of materials and methods, and in the third and fourth chapters are exposed main scientific results and their analysis. The thesis is exposed on 111 pages of typed text and includes 194 sources of literature, 9 annexes, 32 tables, 27 figures.

Scientific publications. Scientific results of the thesis was published in 12 scientific publications, inclusive 2 publications without co-authors. Invention patent "Method for obtaining of natural wines" (Favourable decision, AGEPI, Nr: 8266 from 17.11.2015) was obtained.

Keywords: wine, dealcoholization, alcoholic content, correction of alcoholic content, quality.

THESIS CONTENT

Introduction contains argumentation of the relevancy and importance of the thesis, scientific novelty and originality, theoretical significance and practicality applied value, evaluation of results as well as determination of the purpose and objectives of research.

1. TECHNOLOGICAL ASPECTS OF REDUCED ALCOHOL CONTENT WINE PRODUCTION

In the Chapter 1 on the base of full-bodied study and analysis of latest scientific publications, general information regarding the factors influencing low alcohol wine production, the regulatory framework of the process of ethanol removal and classification and characteristics of methods and techniques for reduced alcohol content wine production is presented.

2. MATERIALS AND METHODS

Chapter 2 contains information regarding the methods for determination of physical−chemical and organoleptic indices, materials of research, the subjects of the study, statistical and mathematical treatment of data is described. In the capacity of subject of research experimental batches of white and red wines as well as partial

dealcoholized wines from Chardonnay, Aligote and Merlot grape varieties with different alcohol content was used.

3. ELABORATION OF OPTIMAL REGIMES FOR CORRECTION OF ALCOHOLIC CONTENT IN WINES USING VACUUM DISTILLATION METHOD

Vacuum distillation process is based on evaporation of most volatile components with low boiling point [3, 10]. Rate of alcohol removal depends on different technological factors: temperature, absolute pressure (hereinafter pressure), operating time, initial volume and initial alcoholic concentration. In the chapter 3 the influence of technological factors on alcohol removal, physical -chemical composition and volatile complex of white wines with the purpose of scientific argumentation of optimal regimes for correction of alcoholic content in white and red wines was studied.

3.1 Influence of dealcoholization process temperature on physical and chemical composition and volatile complex of obtained wines

Temperature is one of the most important technological factors influencing the rate of alcohol removal from wine using vacuum distillation process. Method of vacuum distillation can significantly reduce the boiling point of the alcohol to 25-30˚C. Thus, three temperatures of 20˚C, 30˚C and 40˚C were selected in order to study the influence of temperature on dealcoholization process (table 1).

Table 1. **Influence of dealcoholization process temperature on physical- chemical indices of white wine Chardonnay (P=4 kPa, τ=45 min.)**

Parameter	Initial wine	Temperature		
		20^0C	**30^0C**	**40^0C**
Alcohol content, % vol.	13,5±0,1	13,2±0,1	10,0±0,1	4,7±0,1
Mass concentration of, g/dm³				
-titratable acidity	6,5±0,1	6,6±0,1	7,1±0,1	10,3±0,1
-volatile acidity	0,42±0,03	0,42±0,03	0,37±0,04	0,36±0,04
- sugars	1,3±0,5	1,3±0,5	2,1±0,5	4,8±0,5
-tartaric acid	3,4±0,1	3,4±0,1	3,6±0,1	4,9±0,1
-malic acid	2,4±0,4	2,4±0,2	2,6±0,1	3,9±0,1
-lactic acid	0,1±0,03	0,1±0,03	0,2±0,03	0,5±0,05
-citric acid	0,2±0,04	0,2±0,05	0,3±0,04	0,5±0,03
pH	3,07±0,01	3,07±0,01	3,04±0,01	2,94±0,01
Organoleptic evaluation, points	7,9±0,01	7,9±0,01	7,9±0,01	7,4±0,01

Thus, the experimental data presented in the table 1 demonstrate significant influence of dealcoholization process temperature on ethanol removal from studied wines. The major influence of the temperature 40°C on the wine quality as well as on physical-chemical composition of obtained wines was demonstrated, while temperature of 20°C has the minimal impact on composition of wine as a result of low efficiency of dealcoholization process. Analysis of obtained wines demonstrated, that temperature increase leads to significant modification of wine composition, due

to significant increasing of concentrations of titratable acids, sugars, organic acids and in consequence quality of wine decreases considerable.

Results presented in the figure 1 the influence of dealcoholization process temperature on volatile complex of obtained white dry wines is presented.

According to obtained results presented in fig.1, dealcoholization process temperature influences significantly the volatile complex of white wines. Obtained results demonstrate, that losses of higher alcohols varies from 8,3% to 86,1% in dependence of the process temperature. Being the most volatile wine components along with alcohol [2], esters are practically completely removed from wine at the temperature of 40°C, while temperatures of 20°C and 30°C have the minimal impact on esters losses.

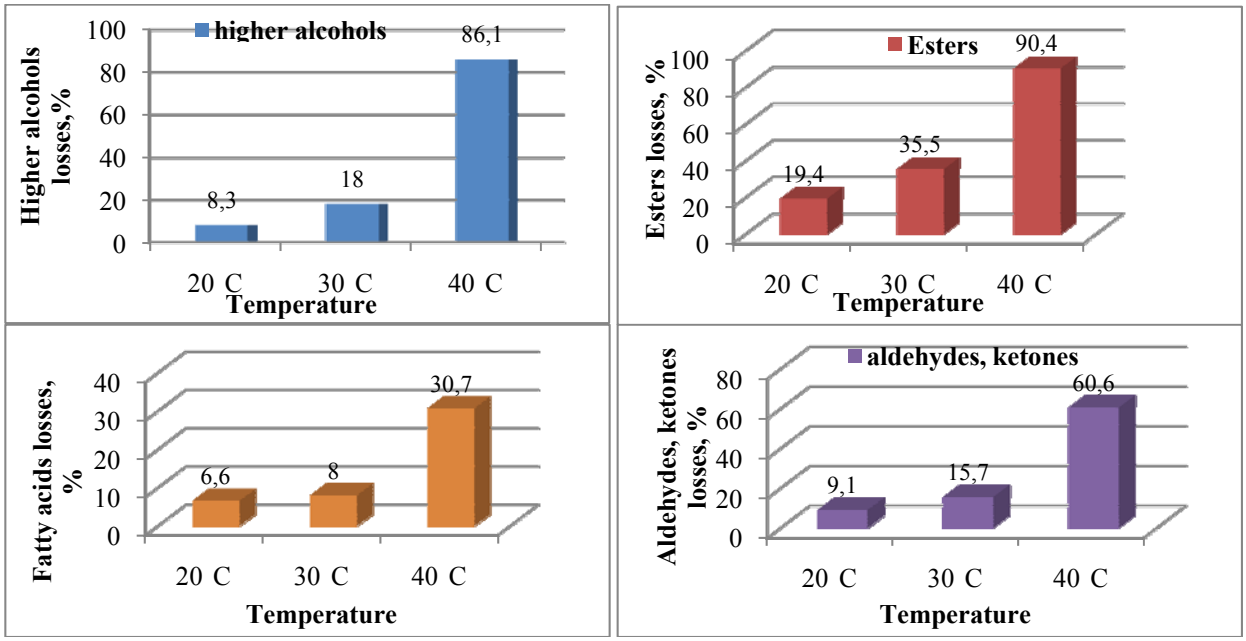

Fig.1. Influence of dealcoholization process temperature on volatile compounds of white wine

Dealcoholization process temperature has the minor impact on fatty acids losses, as a results of high boiling temperatures. The presented data demonstrate, that losses of aldehydes and ketones depend on temperature. The highest loss of aldehydes and ketones is registered at the temperature of 40°C, followed by the temperature of 30°C. The temperature of 20°C has the minor impact on aldehydes and ketones losses, that can be explained by low efficiency of the process of ethanol removal at this temperature.

On the base of obtained results regarding the influence of different temperatures on physical-chemical indices and volatile complex of white dry wines can be concluded, that temperature of 30^0C is the optimal for ethanol removal from wine.

Within the thesis the influence of dealcoholization temperature on concentration of phenolic compounds, antocyanins, biologic active compounds and sensory evaluation of red wine was studied (table 2).

According to the obtained results can be concluded, that temperature of dealcoholization process influences significant the concentration of phenolic compounds, antocyanins and biologic active substances. Concentration of phenolic compounds, antocyanins and rutin increased significantly at the temperature of 50^0C due to wine concentration.

Table 2. **Influence of dealcoholization temperature on polyphenolic complex of obtained red wines (P= 4 kPa, τ=45 min)**

Parameter	Temperature				
	Initial wine	20^0C	30^0C	40^0C	50^0C
Mass concentration of, mg/dm³					
-phenolic compounds	1640±11	1648±9	1726±10	1805±14	2257±8
-antocyanins	174±3	174±4	183±7	194±5	219±9
-rutin	8,1±1,2	9,3±1,4	9,4±1,4	10,4±1,6	10,5±1,6
-quercetine	0,5±0,07	0,5±0,07	0,8±0,1	0,4±0,07	0,3±0,09
-resveratrol	0,3±0,04	0,3±0,04	0,6±0,07	0,3±0,04	0,3±0,04
Organoleptic evaluation, points	7,9±0,01	7,9±0,01	7,9±0,01	7,5±0,01	7,3±0,01

In the process of dealcoholization at the temperature of 30°C the increasing of resveratrol and quercitine concentrations was observed, but at the temperatures of 40°C and 50°C the concentration of studied compound decreased, due to possible destruction of these substances under high temperature. On the base of physical-chemical composition and sensory properties modifications, inclusive the biologic active compounds, the optimal temperature of dealcoholization process of red wines is 30°C.

3.2. Influence of pressure of dealcoholization process on physical- chemical composition and volatile complex of obtained wines

Pressure reduction in the dealcoholization process leads to decrease of alcohol boiling temperature. The influence of the dealcoholization process pressure on physical-chemical composition of obtained wines is presented in the table 3.

Table 3. **Influence of dealcoholization process pressure on physical-chemical composition of white wine Chardonnay (T=30°C, τ=45 min)**

Parameter	Initial wine	Pressure, kPa				
		40	30	20	10	4
Alcoholic content,% vol.	13,5±0,1	13,5±0,1	13,2±0,1	12,5±0,1	10,4 ±0,1	10,0±0,1
Mass concentration of: g/dm³						
-titratable acids	6,5±0,1	6,5±0,1	6,6±0,11	6,8±0,08	7,0 ±0,1	7,1±0,1
-volatile acids	0,42±0,03	0,42±0,03	0,42±0,04	0,41±0,04	0,39±0,03	0,37±0,04
- sugars	1,3±0,5	1,3±0,5	1,3±0,5	1,5±0,5	1,9 ±0,5	2,1±0,5
-tartaric acid	3,4±0,1	3,4±0,1	3,4±0,2	3,5±0,3	3,6±0,2	3,6±0,1
-malic acid	2,4±0,4	2,4±0,2	2,4±0,2	2,5±0,1	2,5 ±0,3	2,6±0,1
-lactic acid	0,1±0,03	0,1±0,03	0,1±0,02	0,2±0,03	0,2±0,03	0,2±0,03
-citric acid	0,2±0,04	0,2±0,03	0,3±0,05	0,3±0,04	0,3±0,05	0,3±0,04
pH	3,07±0,01	3,07±0,01	3,07±0,01	3,07±0,01	3,06±0,01	3,04±0,01

According to obtained results can be concluded, that pressure influences significant on the rate of ethanol removal from wine in the process of dealcoholization. Pressure decrease to 4 kPa improves the efficiency of ethanol removal process and contributes the modification of physical-chemical indices of wines with reduced alcoholic content. (table 3).

Pressures of 10 kPa and 4 kPa have the greatest influence on the dealcoholization process, while in the interval of pressure from 40 kPa to 30 kPa and the temperature of 30°C process of ethanol removal is stopped.

Furthermore, the influence of pressure of dealcoholization process on white wine volatile complex was studied and results are presented in fig. 2.

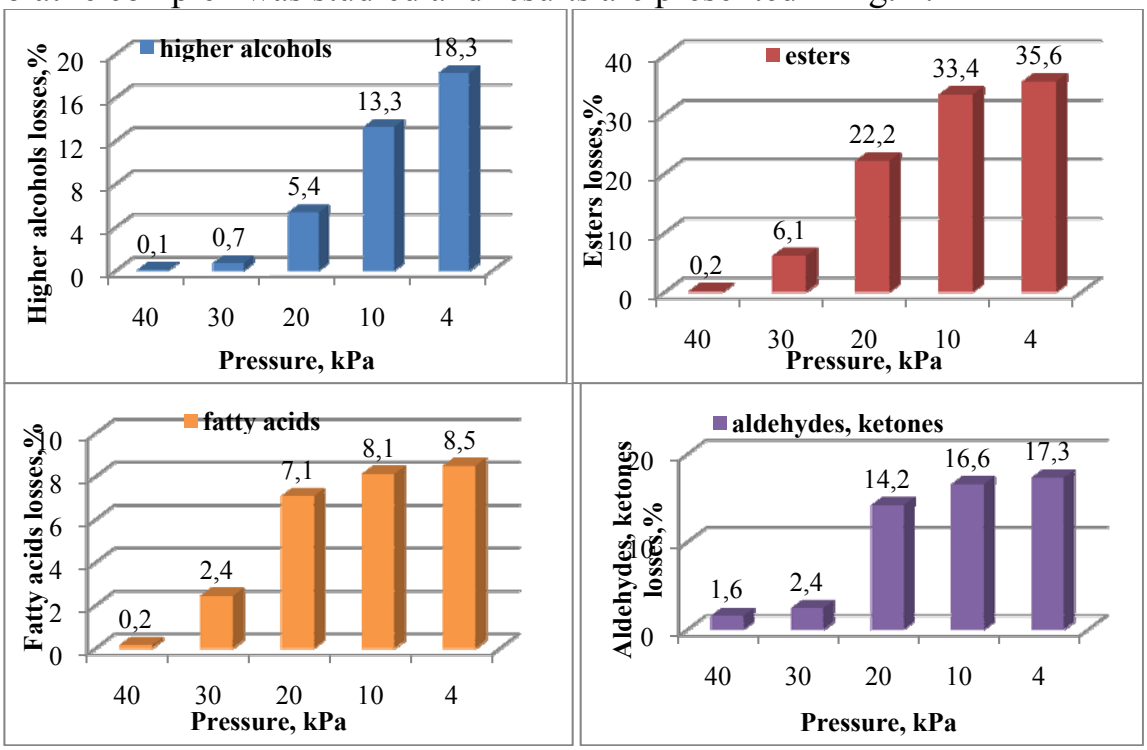

Fig.2. Influence of pressure of dealcoholization process on volatile compounds of white wine Chardonnay

Process of ethanol removal at the pressures of 40 and 30 kPa practically doesn't occur and is characterized with inconsiderable losses of volatile compounds. Simultaneously with pressure reduction, the rate of alcohol removal significantly increases, resulting in rising of volatile compounds losses. Thus, in the result of dealcoholization process, losses of higher alcohols varies from 0,1% to 18,3%, esters from 0,2% to 35,6%, aldehydes and ketones from 1,6% to 17,3% from initial content. Process of ethanol removal at different pressures has minor impact on fatty acids losses, which varies from 0,2% to 8,5% from initial content. Thus, optimal pressure of dealcoholization process varies from 4 to 10 kPa.

3.3. Influence of the process time of dealcoholization process on physical and chemical composition of obtained white wines

In the research results regarding the influence of the process time of the dealcoholization on the chemical-physical parameters of white wines are shown in the table 4.

According to results presented in the table 4, dealcoholization process time the influences significant on the alcoholic content, which varies from 13,5 % vol. to 4,1% vol. chemical-physical indices of obtained white wines. Mass concentration of titratable acids, sugars, organic acids is in direct relation to the process duration. Lengthening of the operation time leads to increasing of the concentration of non-volatile components, due to concentration of wines as a result of water removal along with alcohol in the process of dealcoholization. Dealcoholization process affects the

mass concentration of volatile acids, which decreased, probably as a consequence of some acetic acid molecules losses during distillation. According to results of sensory evaluation, can be concluded, that process of ethanol removal influences significantly the quality of obtained wines. Thus, 20% reduction of alcoholic content doesn't affect the quality of wines, but reduction of alcoholic strength to 4,1% vol reduces significantly the quality of obtained wines.

Table 4. **Influence of the dealcoholization process time on chemical and physical parameters of white dry wine Chardonnay (T=30˚C, P=4 kPa)**

Time, min	Alcohol content, % vol.	Mass concentration of, g/dm³							Organoleptic evaluation, points
		titratable acids	volatile acids	sugars	tartaric acid	malic acid	lactic acid	citric acid	
Initial wine	13,5±0,1	6,5±0,1	0,42±0,03	1,3±0,5	3,4±0,1	2,4±0,4	0,1±0,03	0,2±0,04	7,9±0,01
5	13,1±0,1	6,6±0,09	0,42±0,03	1,3±0,5	3,4±0,1	2,4±0,2	0,1±0,02	0,3±0,05	7,9±0,01
10	12,8±0,1	6,7±0,08	0,42±0,03	1,5±0,5	3,5±0,2	2,4±0,1	0,1±0,02	0,3±0,05	7,9±0,01
15	11,3±0,1	6,8±0,09	0,42±0,03	1,6±0,5	3,5±0,1	2,5±0,1	0,1±0,02	0,3±0,05	7,9±0,01
20	10,7±0,1	6,9±0,11	0,40±0,04	1,8±0,5	3,5±0,3	2,5±0,1	0,1±0,03	0,3±0,06	7,9±0,01
25	10,4±0,1	7,0±0,1	0,39±0,03	1,9±0,5	3,6±0,1	2,5±0,1	0,2±0,04	0,3±0,06	7,85±0,01
30	10,1±0,1	7,0±0,12	0,38±0,04	2,0±0,5	3,6±0,1	2,5±0,2	0,2±0,03	0,3±0,05	7,85±0,01
45	9,8±0,1	7,1±0,1	0,37±0,04	2,1±0,5	3,6±0,1	2,6±0,1	0,2±0,03	0,3±0,04	7,85±0,01
60	8,3±0,1	7,9±0,1	0,37±0,02	2,5±0,5	4,1±0,2	2,8±0,3	0,3±0,03	0,4±0,06	7,75±0,01
90	7,9±0,1	9,2±0,1	0,37±0,03	2,6±0,5	4,5±0,4	3,2±0,1	0,4±0,04	0,5±0,03	7,6±0,01
100	5,8±0,1	10,5±0,09	0,35±0,04	4,1±0,5	5,0±0,1	4,0±0,1	0,5±0,03	0,6±0,08	7,4±0,01
120	4,1±0,1	11,2±0,09	0,33±0,04	5,1±0,5	5,3±0,1	4,3±0,1	0,6±0,02	0,6±0,07	7,4±0,01

In the thesis was studied the influence of process time on changes of volatile compounds of white wines with reduced alcoholic content (fig. 3).

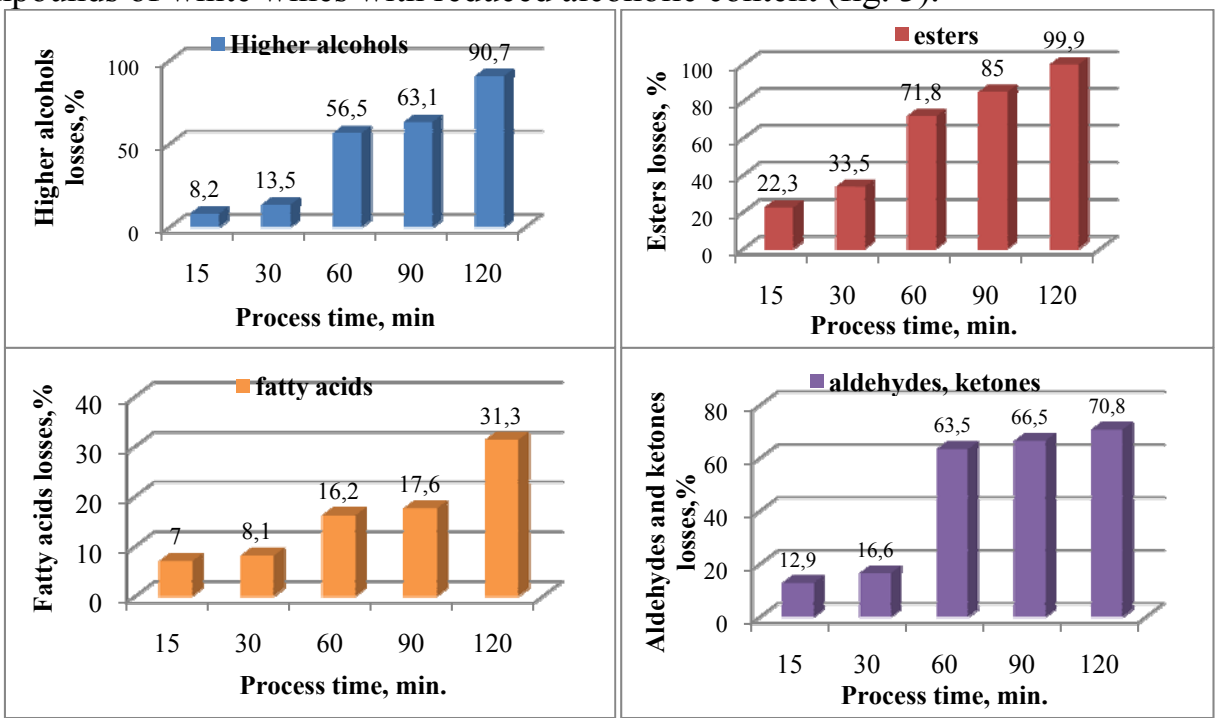

Fig.3. Influence of the operating time of dealcoholization process on volatile compounds of white wine Chardonnay

According to obtained results presented in the fig. 3, lengthening of dealcoholization process time leads to significant removal of ethanol and volatile compounds from wine. Alcoholic content reduction to 4,1% vol (120 min) contributes the complete removal of esters, aldehydes, ketones and higher alcohols from wine. Fatty acids, due to high boiling point, are affected in a lesser extent by dealcoholization process.

Thus, can be concluded, that process time of the dealcoholization process depends on quantity of ethanol removed from wine.

3.4. Influence of wine volume in the dealcoholization process on physical and chemical parameters of obtained white wines

In order to determine the influence of volume of wine aimed to dealcoholization, the experimental samples of white wines with different initial volume was obtained and the main physical-chemical indices and volatile compounds were determined. According to the data presented in the table 5, significant dependence between the initial volume of wine and alcohol removal is observed.

Thus, at the volume of 0,25 dm³ a significant reduction of alcoholic content from wine occurs resulting in an significant increase of mass concentration of titratable acids, sugars and organic acids.

Table 5. **Influence of volume of wine on physical-chemical parameters of white wine Chardonnay (T=30°C, P=4 kPa, τ=45 min)**

Parameter	Initial wine	Volume of wine, dm³			
		0,25 (1/4)	0,50 (1/2)	0,75 (3/4)	1 (1/1)
Alcohol content, % vol.	13,5±0,1	8,9±0,1	10,0±0,1	11,9±0,1	13,2±0,1
Mass concentration of, g/dm³					
-titratable acids	6,5±0,1	7,4±0,1	7,1±0,1	6,7±0,1	6,6±0,1
-volatile acids	0,42±0,03	0,37±0,04	0,37±0,04	0,41±0,03	0,42±0,04
-sugars	1,3±0,5	2,3±0,5	2,1±0,5	1,4±0,5	1,3±0,5
-tartaric acid	3,4±0,1	3,8±0,1	3,6±0,1	3,4±0,2	3,4±0,2
-malic acid	2,4±0,4	2,7±0,3	2,6±0,1	2,4±0,1	2,4±0,1
-lactic acid	0,1±0,03	0,2±0,02	0,2±0,03	0,1±0,03	0,1±0,03
-citric acid	0,2±0,04	0,3±0,04	0,3±0,04	0,3±0,03	0,3±0,05
pH	3,07±0,01	3,04±0,01	3,04±0,01	3,06±0,01	3,07±0,01
Volume losses, %	-	12	8	4	<1
Organoleptic evaluation, points	7,9±0,01	7,7±0,01	7,8±0,01	7,9±0,01	7,9±0,01

Besides this, the reduction of initial volume to 0,25 dm^3 demonstrated 12% losses of wine volume. Increasing of initial volume from 0,5 to 1,0 dm³ leads to insignificant decrease of ethanol removal rate from wine, which is confirmed by the results of analysis: alcoholic content decreased only on 0,3% vol and mass concentration of titratable acids, sugars, volatile acids, pH remained unchanged in the process of dealcoholization. Furthermore, results regarding the losses of volatile compounds in the process of dealcoholization in dependence of the initial wine volume have the significant practical interest (fig. 4).

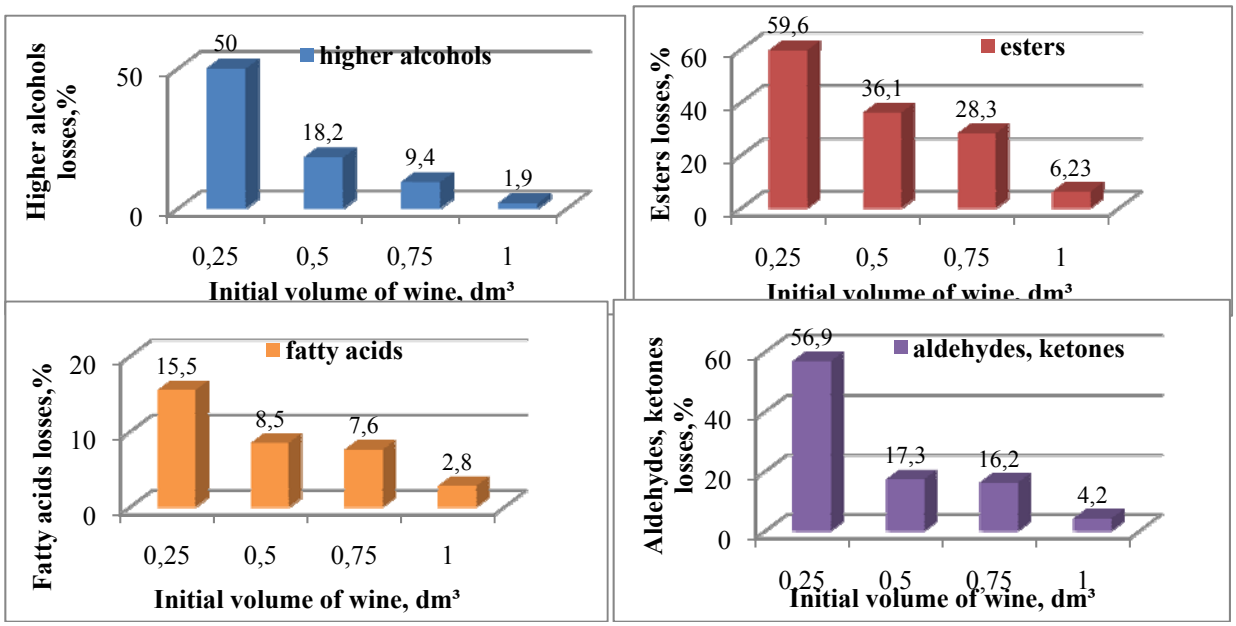

Fig.4. Influence of initial wine volume for dealcoholization on volatile compounds of white wine Chardonnay

According to the results presented in fig. 4, reduction of initial volume of wine in the process of dealcoholization facilitates not only ethanol removal, but also that of volatile compounds. Thus, maximal losses of higher alcohols, esters, aldehydes, ketones and fatty acids were observed at the minimal volume of wine. Increasing of volume of wine for dealcoholization leads to reduction of volatile compounds losses. In production conditions increasing of initial volume of wine require the concomitant increasing of processing time of process for achievement of desired alcoholic concentration.

3.5 Influence of initial alcoholic content of wine for dealcoholization on physical-chemical parameters of white wines

In order to determine the influence of initial alcohol content of wine for dealcoholization, on the rate of alcohol removal process, the samples of white wines with different alcoholic content were obtained by administration of pure alcohol. The dealcoholization process was carried out after 24 hours, in order to allow the assimilation of alcohol added to wine and dealcoholization process was carried in the laboratory conditions (table 6).

According to results presented in table 6, increasing of the initial alcohol content leads to increasing of the fraction of removed alcohol from wines in the process of dealcoholization, due to the fact, that highest alcoholic content in wines means the highest concentration of ethanol and its vapors, that facilitates the process of ethanol removal under reduced pressure. Furthermore, water-alcohol mixture is enriched by ethanol, which accelerates the process of dealcoholization too.

Mass concentration of titratable acids, volatile acids, oganic acids, sugars and pH remains practically unchanged after increasing of alcoholic content in initial wines from 13 to 16% vol.

Table 6. **Chemical-physical parameters of white dealcoholized wines with different alcohol content in the initial wine (T=30°C, P=4 kPa, τ=30 min)**

Parameter	Alcoholic content, % vol.			
	13±0,1	**14±0,1**	**15±0,1**	**16±0,1**
% of reduced alcoholic content, % vol.	1,8	2,6	3,5	4,2
Mass concentration of, g/dm³				
-titratable acids	6,4±0,11	6,3±0,1	6,3±0,12	6,2±0,1
-volatile acids	0,32±0,03	0,33±0,04	0,33±0,04	0,33±0,03
-sugars	1,3±0,5	1,3±0,5	1,3±0,5	1,3±0,5
-tartaric acid	3,6±0,3	3,6±0,1	3,6±0,2	3,5±0,1
-malic acid	1,2±0,1	1,2±0,1	1,2±0,2	1,1±0,1
-lactic acid	0,5±0,02	0,5±0,04	0,5±0,02	0,5±0,03
-citric acid	0,3±0,03	0,3±0,04	0,3±0,03	0,3±0,03
pH	3,23±0,01	3,23±0,01	3,23±0,01	3,23±0,01

3.6. Statistical and mathematical analysis of the results

In the thesis obtained data regarding the influence of physical factors: temperature, pressure, operating time and volume on ethanol removal from white and red wines was statistically evaluated using program StatGraphics Plus 5.0.

Analysis of obtained results has shown, that rate of alcohol removal from wines depends the following factors: operating time (X_1), temperature (X_2), pressure (X_3) and volume (X_4) and alcoholic content was selected as dependent variable (Y).

The results of fitting a simplified multiple linear regression model to describe the correlation between alcoholic content (Y) and 3 independent variables (time, temperature, pressure and volume) for white wine Chardonnay are presented below.

The equation of the fitted simplified model is:

$Y = 16{,}0394 - 0{,}0710417*X_1 - 0{,}229792*X_2 + 9{,}9881*X_3$, where

Y-alcoholic concentration, % vol.;

X_1 – operating time, min;

X_2 – temperature, ºC;

X_3 – pressure, kPa.

According to obtained model the influence of initial volume can be excluded from regression equation. It was established that temperature and pressure are the main technological factors influencing the process of ethanol removal from wine.

4. IMPROVEMENT OF TECHNOLOGICAL REGIMES FOR CORRECTION OF ALCOHOLIC CONTENT IN WINES

In the chapter 4 the research was focused on perfection of technological regimes for correction of alcoholic content in dry wines.

4.1. Perfection of technological regimes for correction of alcoholic content in dry wines

In order to establish optimal conditions of ethanol removal for obtaining of wine with corrected alcoholic content without significant aroma losses the process was carried out at the different stages of wine production:

1. Dealcoholization of the fermenting wort (**Scheme 1**);

2. Dealcoholization of the dry wine resulting from complete fermentation of sugars (**Scheme2**).

Investigation was carried out was by vacuum distillation process using optimal technological regimes.

Table 7. **Chemical- physical indices of white wines with corrected alcoholic content (T=30°C, P=4 kPa, τ=30 min)**

Parameter	Initial wine	Scheme	
		1	2
Alcohol content, % vol.	13,1±0,1	11,5±0,1	11,3±0,1
Mass concentration of, g/dm³			
-titratable acids	6,6±0,10	6,9±0,1	7,0±0,1
-volatile acids	0,26±0,03	0,26±0,03	0,26±0,04
-sugars	1,5±0,5	1,6±0,5	1,6±0,5
-tartaric acid	3,4±0,1	3,5±0,2	3,5±0,2
-malic acid	2,7±0,1	2,8±0,3	2,8±0,3
-lactic acid	0,1±0,03	0,2±0,05	0,2±0,03
-citric acid	0,2±0,06	0,3±0,04	0,3±0,04
-higher alcohols, mg/dm³	179	100	133
-esters, mg/dm³	60	25	40
-fatty acids, mg/dm³	218	103	116
-aldehydes and ketones, mg/dm³	32	24	18
pH	3,07±0,01	3,07±0,01	3,06±0,01
Organoletic evaluation, points	7,90±0,01	7,70±0,01	7,90±0,01

The experimental data presented in table 7 indicate, that obtained wines with corrected alcoholic content differ in chemical-physical indices in comparison to initial wine by reducing of alcoholic content, increasing the concentrations of titratable acids etc. Organoleptic evaluation has shown, that wine obtained by scheme 2 received 7,9 points and wine obtained by scheme 1 only 7,7 points in comparison with initial wine, which received 7,9 points.

Besides this, analysis of volatile complex of white dealcoholized experimental wines demonstrated, significant difference between schemes 1 and 2. Wine obtained by the scheme 1 is characterized by significant losses of esters and higher alcohols resulting in oxidated wines with unexpressed aromas, due to the fact that dealcoholization of fermenting wort is accompanied by considerable exhalation of CO_2. Whereas, losses of aroma compounds in wines obtained by scheme 2 are much less than in wines obtained by scheme 1, resulting in more balanced wines with corrected alcoholic content.

For the production of wines with corrected alcoholic content and with complex aromas the method of blending the partial dealcoholized wine with full natural dry wine was proposed. Physical-chemical indices of white dry wines with corrected alcoholic content obtained by blending method are presented in the table 8. Partial dealcoholized wine was obtained by utilization of elaborated technological regimes.

Table 8. **Chemical-physical indices of white wines with corrected alcoholic content obtained by blending method**

Relation, %	Alcohol content,% vol.	Mass concentration of, g/dm³							Sensory evaluation, points
		titratable acids	volatile acids	sugars	tartaric acid	malic acid	lactic acid	citric acid	
wine 1*	13,5±0,1	6,5±0,1	0,42±0,03	1,3±0,5	3,4±0,1	2,4±0,4	0,1±0,03	0,2±0,04	7,9±0,01
wine 2 **	9,0±0,1	7,2±0,1	0,37±0,03	2,2±0,5	3,7±0,2	2,6±0,1	0,2±0,02	0,3±0,04	7,7±0,01
1:2=50:50	11,3±0,1	6,8±0,09	0,39±0,02	1,7±0,5	3,5±0,2	2,5±0,1	0,1±0,03	0,3±0,02	7,9±0,01
1:2=60:40	11,6±0,1	6,7±0,11	0,40±0,04	1,6±0,5	3,5±0,2	2,4±0,2	0,1±0,04	0,3±0,02	7,9±0,01
1:2=40:60	10,7±0,1	6,9±0,08	0,39±0,02	1,9±0,5	3,6±0,1	2,5±0,2	0,2±0,03	0,2±0,03	7,8±0,01
1:2=30:70	10,5±0,1	7,1±0,1	0,38±0,03	1,9±0,5	3,6±0,1	2,5±0,1	0,2±0,04	0,3±0,04	7,8±0,01
1:2=20:80	9,7±0,1	7,1±0,12	0,38±0,04	2,0±0,5	3,6±0,2	2,6±0,2	0,2±0,04	0,3±0,04	7,8±0,01
1:2=70:30	12,2±0,1	6,7±0,09	0,4±0,03	1,6±0,5	3,3±0,1	2,4±0,1	0,1±0,03	0,3±0,02	8,0±0,01
1:2=80:20	12,5±0,1	6,5±0,08	0,41±0,03	1,5±0,5	3,4±0,1	2,4±0,12	0,1±0,03	0,2±0,03	8,0±0,01

*Wine 1- Initial white dry wine Chardonnay

**Wine 2- Partial dealcoholized white wine Chardonnay obtained using vacuum distillation process

The data presented in table 8 indicate, that blending of wines can serve a method of producing and improving the quality of wines with corrected alcoholic content. Physical-chemical indices of obtained wines vary in dependence of the ratio of blended components. Results of sensory evaluation demonstrate, that blending of initial wine with partial dealcoholized wine in ratios from 1:2=50%:50% to 1:2=70%:30% allows obtaining of high quality wines with corrected alcoholic content. Obtained results demonstrate, that blending method contributes the improvement of the effectiveness of dealcoholization process, leads to substantial reduction of operating time and amelioration of quality for wines with reduced alcoholic content, as well as restitution of the aromatic complex of final wine.

4.2. Influence of dealcoholization process on wine stability

Dealcoholization process is followed by ethanol removal from wine and concomitant process of wine concentration occurs and certain change of wine balance can lead to instability against different hazes [1]. Thus, influence of dealcoholization process on wine stability is very complex question and requires the follow-up study.

Table 9. **Influence of dealcoholization process on stability of white wine Chardonnay (T=30°C, P=4 kPa)**

Parameter	Initial wine	Alcoholic concentration in dealcoholized wines, % vol				
Alcohol content, % vol	14,3	13,2	12,1	11,3	8,5	5
Potassium, mg/dm³	421	422	435	459	506	715
Tartaric acid, g/dm³	2,0	2,0	2,1	2,1	2,4	3,3
Stability:						
-bio-chemical	+	+	+	+	+	-
-protein	+	+	+	+	+	-
-colloidal	+	+	+	+	+	-
-crystal haze	+	+	+	+	+	-
-microbiological	+	+	+	+	-	-

Legend: + stable
-unstable

According to obtained results presented in table 9, stability of wines with reduced alcoholic content depends on the stability of initial wine and rate of ethanol removal. Reduction of alcoholic content to 11,3% vol has no influence on the stability of white wines, but decreasing of alcoholic content to 5,0% vol influences significant on stability of studied wines. Dealcoholization process leads to increase of mass concentration of tartaric acid, potassium and other non-volatile compounds as a result of wine concentration. Testing of wines with different alcoholic content demonstrated, that reduction of alcoholic content to 8,5% vol leads to microbiological destabilization, but reduction to 5,0% vol leads to total reduction of white wine stability.

4.3. Influence of the dealcoholization process on organoleptic properties of white wines

In order to establish the influence of dealcoholization process by vacuum distillation method on organoleptic properties, experimental samples of white wine Chardonnay with different alcohol content was studied. On the base of organoleptic evaluation the sensory profile was obtained (fig. 5).

Figure 5 reports the sensory profile of initial white wine Chardonnay and after dealcoholization process. According to the obtained results, it can be concluded, that elimination of different amount of alcohol from wines influences in various extents on organoleptic properties of obtained wines.

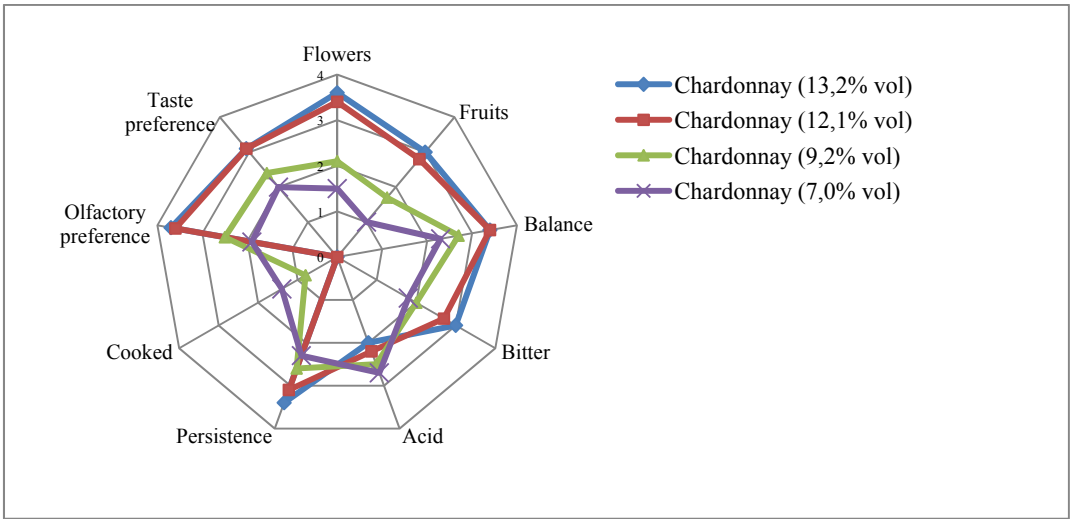

Fig.5. Sensory profiles of white wine Chardonnay before and after the dealcoholization process

For white wine the most decreased olfactory attributes were "flowers" and "fruits" responsible for floral and fruit aroma. Besides this, appearance of green notes also known as herbal, herbaceous and leaf-like as a result of removal of esters leading to increasing of fatty acids concentration in ratio to other aroma compounds was observed. In the process of dealcoholization light cooked notes appeared (Chardonnay 7,0% vol**).** Acidity of obtained dealcoholized wines increased in dependence of the eliminated amount of alcohol and probably a part of water leading to disrupting the balance of wine significantly affecting the taste and olfactory preference.

4.4. Production testing and implementation of improved technology for correction of alcoholic content in wines using vacuum distillation method

On the base of elaborated in the laboratory conditions optimal technological regimes for ethanol removal from wines the technological scheme of alcoholic content correction in white and red wines was elaborated and implemented in production on the winery "Nectar S" LTD. Installation "Tetra Therm Aseptic Drink" by "Alfa Laval" (Sweden) was used for correction of alcoholic content in wines.

On the first stage white and red wine with high alcoholic content was selected in order to be used in the process of ethanol correction. In capacity of wines for dealcoholization white wine Aligote (h.y. 2014) with alcoholic content of 13,9% vol and red wine Merlot (h.y. 2014) with alcoholic content of 14,1% vol were selected. The correction of alcoholic content was conducted according to the OIV Resolution, with removal of 20% of the total alcoholic content. The process of ethanol removal was carried out periodically by vacuum distillation installation using elaborated technological regimes: temperature 30±1ºC with constant pressure of the process (4 kPa) and initial volume - 1000 dal for both wines. The main physical-chemical indices of white and red wines was determined and presented in the table 10.

According to obtained results presented in table 10, initial physical-chemical analysis of wines after alcohol strength correction has shown insignificant influence of the process on wine composition except for alcohol. Reduction of alcohol in white wines constitutes 2,4% vol for white wine Aligote and for red wine Merlot 2,1% vol.

Table 10. **Physical-chemical indices of initial and wines with corrected alcoholic content**

Nr.	Wine	Alcohol content,% vol.	Mass concentration of, g/dm³			pH	SO_2 total/free, mg/dm³	Sensory evaluation, points
			titratable acids	volatile acids	sugars			
1	Aligote*	13,9±0,1	5,5±0,08	0,36±0,03	1,0±0,5	3,07±0,01	120/31	7,9±0,01
2	Aligote**	11,5±0,1	5,7±0,08	0,33±0,03	1,2±0,5	3,05±0,01	110/21	8,0±0,01
3	Merlot*	14,1±0,1	5,1±0,1	0,39±0,03	1,2±0,5	3,24±0,01	103/22	7,9±0,01
4	Merlot**	12,0±0,1	5,4±0,1	0,37±0,03	1,5±0,5	3,20±0,01	91/12	8,0±0,01

Legend: *-initial wine

**-wine with corrected alcoholic content

Organoleptic evaluation of obtained wines with reduced alcohol content demonstrates the positive effect of dealcoholization process on wine quality. Obtained white and red wines were appreciated with 8,0 points.

On the base of scientific results obtained in laboratory and production conditions 2 technological schemes for correction of alcoholic content in white and red dry wines by vacuum distillation method was elaborated and are presented in fig. 6, 7.

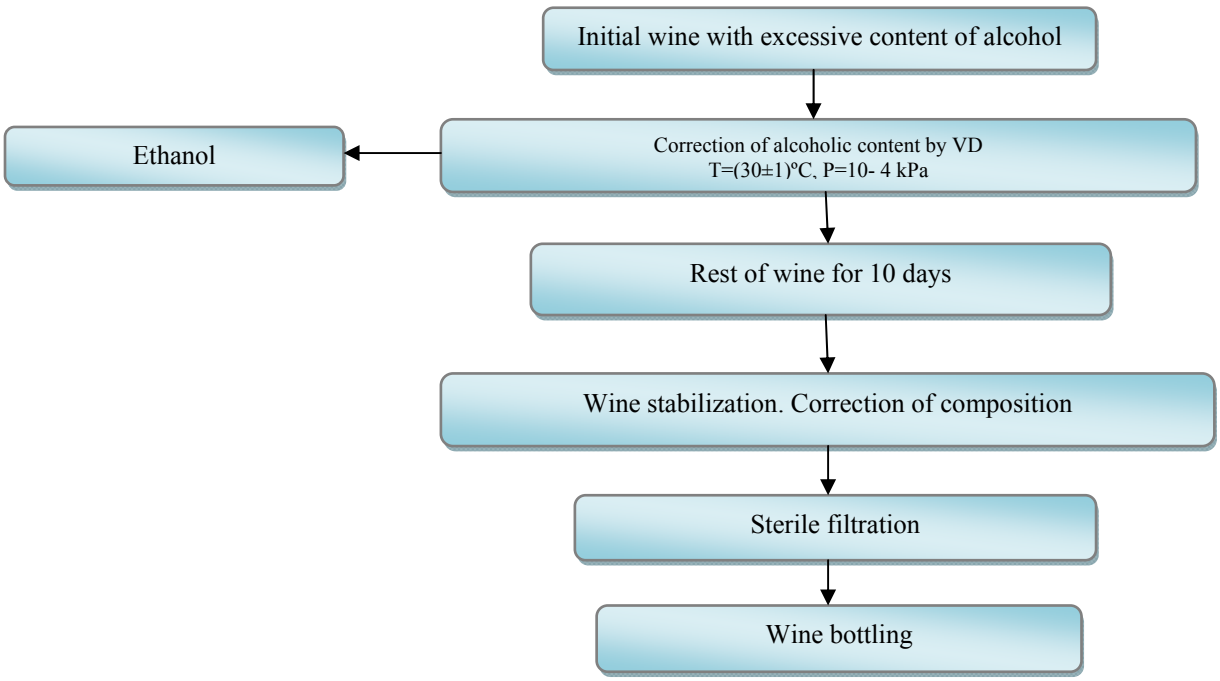

Fig.6. Technological scheme of alcoholic strength correction in dry white and red wines by vacuum distillation method

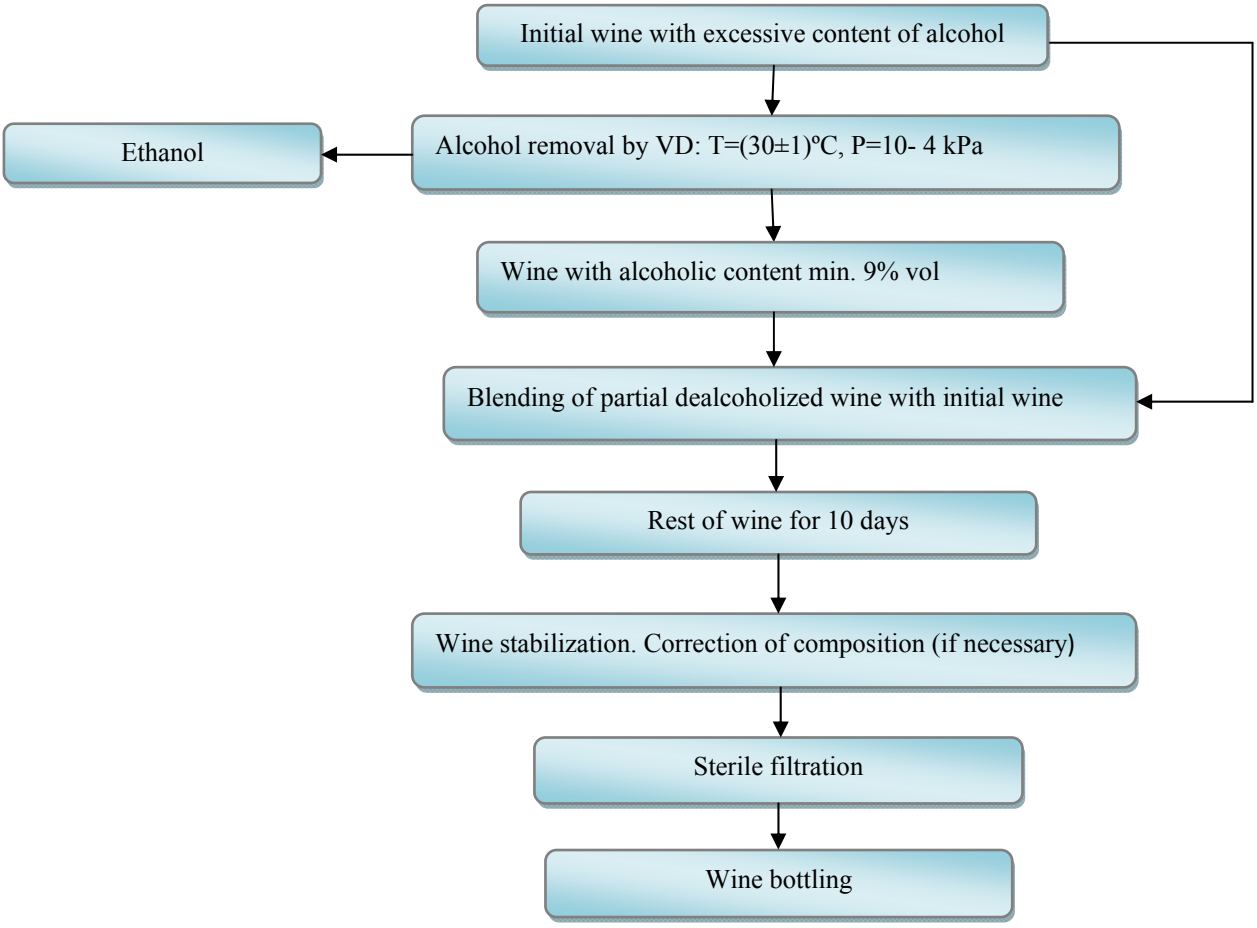

Fig. 7. Technological scheme for production of dry wines with corrected alcoholic content by blending method

First scheme (fig. 6) includes correction of alcoholic content by vacuum distillation method with elimination of 20% of ethanol from initial content.

Second scheme (fig. 7) is based on blending of partial dealcoholized wine with initial in different proportions.

GENERAL CONCLUSIONS AND RECOMMENDATIONS

Generalizing obtained scientific and practical results of research, presented in the thesis the following conclusions and recommendations can be made:

1. For the first time the correlation between parameters of technological process of wine dealcoholization and final alcoholic content in wines with corrected alcoholic contentration was elaborated and argumented.
2. Optimal technological regimes for correction of alcoholic content in white and red wines using vacuum distillation method was scientifically substantiated: temperature (30±1)°C, pressure from 10 to 4 kPa and processing time in dependence of initial wine volume and quantity of alcohol eliminated from wine.
3. It was determined, that increasing of dealcoholization temperature from 20 ºC to 40 ºC the significant losses of volatile complex are observed: higher alcohols from 8,3% to 86,1%, esters from 19,4% to 90,4%, acids from 6,6% to 30,7% and aldehydes, ketones from 9,1% to 60,6% in dependence of process temperature.
4. Pressure reduction in the process of dealcoholization from 40 kPa to 4 kPa leads to moderate losses of volatile compounds: higher alcohols from 0,1% to 18,3%, esters from 0,2% to 35,6%, acids from 0,2% to 8,5%, aldehydes, ketones from 1,6% to 17,3% in dependence of the process pressure.
5. In dependence of dealcoholization processing time the reduction of higher alcohols constitutes from 8,2% to 90,7%, esters from 22,3% to 99,9%, acids from 7,1% to 31,3% and aldehydes, ketones from 12,9% to 70,8%.
6. On the base of undertaken study in laboratory conditions an adequate mathematical model, reflecting the influence of physical factors of dealcoholization process on alcohol removal was obtained. It was established that Temperature and Pressure are the main technological factors influencing the process of ethanol removal.
7. According to obtained results, blending of initial wine with partial dealcoholized wine in proportions 50%:50% and 70%:30% contributes the improvement of the effectiveness of dealcoholization process, leads to substantial reduction of operating time and amelioration of quality for wines with reduced alcoholic content. Novelty of elaborated technology is confirmed by Utility patent application “Method for obtaining of natural wines” Nr: s 2015 0056 from 2015.04.17
8. It was demonstrated that reduction of alcoholic concentration to 8,5% vol leads to microbiological instability, but reduction of alcoholic content to 5,0% vol influences total destabilization of wines.

9. It was found, that sensory characteristics of wines obtained by dealcoholization using vacuum distillation method, depend on ethanol removal rate. Reduction of initial alcoholic content to 20% contributes improvement the sensory characteristics of obtained white and red wines in comparison with initial wine.
10. Elaborated technological regimes of white and red wines with corrected alcoholic content was successfully tested in production conditions at wine factory at "Nectar S" LTD and are recommended for implementation. Total volume of implementation of improved technology for white and red wines with corrected alcoholic content production constituted 2000 dal.

RECOMMENDATIONS

On the base of obtained results it is recommended:

- Vacuum distillation method is recommended for correction of alcoholic content in wines in limits proposed by OIV (reduction of alcoholic content constitutes 20%).
- Conduction of the process of ethanol removal from wine using elaborated technological regimes T=(30±1)ºC, pressure from 10 to 4 kPa;
- Using for the process of ethanol removal a wine without any defects;
- Partial dealcoholization of wine to 9% vol with subsequent blending with initial wine in proportion 30%:70% and 50%:50%.

BIBLIOGRAPHY

1. Валуйко Г.Г., Зинченко В.Н., Мехузла Н.А. Стабилизация виноградных вин. Симферополь: Таврида, 1999. 208 с.
2. Belisario-Sánchez Y. Y. et al. Dealcoholized wines by spinning cone column distillation: Phenolic compounds and antioxidant activity measured by the 1,1-diphenyl-2-picrylhydrazyl method. In: J. Agric. Food. Chem., 2009, vol. 57(15), p. 6770-6778.
3. Fischer U. The impact of dealcoholization on the flavor of wine – relating concentration of aroma compounds to sensory data using PLS analysis. In: Flavour Science: Recent Developments, 1996, p.336-338.
4. Liguori L.et al. Aglianico wine dealcoholization test. In: 20th European Symposium on Computer Aided Process Engineering – ESCAPE20, 2010, 6 p.
5. Ozturk B., Anli E. Different techniques for reducing alcohol levels in wine: A review. In: BIO Web of Conferences, 2014, vol. 3, p. 1-8.
6. Saha B. et al. Review of processing technology to reduce alcohol levels in wines. In: 1st International Symposium Alcohol level reduction in wine-Oenoviti International Network. France, 2013, p.78-86
7. Salamon A. Techniques to achieve moderate alcohol levels in South African wine. Master Diploma. Cape town, 2006. 57 p.
8. Saliba A. et al. Consumer attitudes to low alcohol wine: an Australian sample. In: Wine and Viticulture Journal, 2013, p. 58-61.
9. Seccia A. et al. Consumers' attitudes towards new products derived from wine dealcoholization. In: XX Enometrics Conference, Talca, Chilie, 2013, p.71-73.
10. Vacuum distillation process. http://en.wikipedia.org/wiki/Vacuum_distillation (visited 07.06. 2015)

SCIENTIFIC PUBLICATIONS

Articles in national peer-reviewed journals, C category

1. **Stoleicova S**., Comparative analysis of the techniques used to reduce alcohol level in wines. In: Pomicultura, Viticultura şi Vinificaţia, nr. 2 [56], 2015, p.35-37. *ISSN 1857-3142.* (Categoria C)

2. **Stoleicova S.,** Influence of dealcoholization process on stability of white and red wines against different hazes. In: Pomicultura, Viticultura şi Vinificaţia, 2015. *ISSN 1857-3142.*(Categoria C).

2. Articles in scintific collections

2.1. Articles in international conferences

3. Taran N., **Stoleicova S.,** Adajuc V., Soldatenco O., Morari B., Taran M., Influenţa duratei procesului de dealcoolizare asupra indicilor fizico-chimici a vinurilor albe seci. In: Materialele Simpozionului Ştiinţific Internaţional „Agricultura Modernă – Realizări şi Perspective", Chisinau (Republic of Moldova), UASM, vol. 36 (1), 2013, p. 433-436. *ISBN 978-9975-64-248-4.*

4. Таран Н., **Столейкова С**., Влияние температуры процесса деалкоголизации на физико-химические показатели красных сухих вин. In: Materialele Simpozionului Ştiinţific Internaţional „Agricultura Modernă – Realizări şi Perspective", Chisinau (Republic of Moldova), UASM, vol. 36 (1), 2013, p. 436-439. *ISBN 978-9975-64-248-4.*

5. Taran N., **Stoleicova S**., The influence of initial alcohol content in wine on dealcoholization process. In: Proceedings of International Conference "Modern Technologies in the Food Industry", Chisinau (Republic of Moldova), Ed.: Technica-Info, 2014, p. 319-322. *ISBN 978-9975-80-840-8.*

6. Taran N., **Stoleicova S**., Soldatenco O., Morari B., The influence of pressure on chemical and physical parameters of white and red wines obtained by dealcoholization method. In: Journal of Agroalimentary Processes and Technologies, 2014, vol. 20 (3), Timisoara (Romania), p**.** 215-219**.** *ISSN- 2069-0053.*

7. **Stoleicova S**., Taran N., Soldatenco E., Elaboration of technologies for production of white and red wines with reduced alcoholic content. In: Materialele Simpozionului Ştiinţific Internaţional „Horticultura modernă– realizări şi perspective", Chisinau (Republic of Moldova), UASM, 2015, vol. 42 (2), p. 282-285. *ISBN 978-9975-64-273-6*

3. Materials of scientific forums

3.1. international conferences (abroad)

8. Таран Н., **Столейкова С**., Влияние температуры процесса деалкоолизации на физико-химические показатели белых сухих вин. Международный научно-практический форум «Роль экологизации и биологизации в повышении эффективности производства плодовых культур, винограда и продуктов их переработки», 26-30 августа 2013, Краснодар, с. 130-134, *ISSN 2308-8567.*

9. Таран Н., Солдатенко Е., **Столейкова С**., Влияние процесса деалкоголизации на полифенольный комплекс красных вин. Международная научно - практическая интернет – конференция «Инновационные технологии и тенденции в развитии современного виноградарства и виноделия», 1-3 июля 2014, Ялта, Национальный Институт Винограда и Вина «Магарач», с.77-78.

10. Таран Н.Г., **Столейкова С.С**., Солдатенко Е.В., Гнетько Л.В., Влияние процесса деалкоолизации на качественные показатели белых и красных вин. Международная научно-практическая конференция: «Современные проблемы и тенденции развития пищевой промышленности», 15 апреля 2015, Майкоп, с. 68-72, *ISBN 978-5-906696-23-6.*

3.2. international conferences in republic

11. Taran N., **Stoleicova S**., Microbiological aspects of wines obtained by dealcoholization process. In: 2nd International Conference on Microbial Biotechnology, 9-10 October 2014, Chisinau, IBM**,** p. 185, *ISBN 978-9975-4432-8-9.*

Patents

12. Taran N., **Stoleicova S**., Soldatenco E., *„Procedeu de obţinere a vinurilor naturale"*. Hotărîre pozitivă, AGEPI, Nr: 8266 din 17.11.2015.

ADNOTARE

Stoleicova Svetlana ”Tehnologia de producere a vinurilor seci pe baza corectării gradului de alcool”. Teză de doctor în ştiinţe tehnice, Chişinău 2015. Teza constă din introducere, 4 capitole, concluzii şi recomandări, bibliografia ce include 194 titluri, 9 anexe, 111 pagini de conţinut de bază, 32 tabele, 27 figuri. Rezultatele au fost expuse în 12 publicaţii.

Cuvinte-cheie: vin, concentraţia alcoolică , dealcoolizare, calitate.

Domeniul de studiu: 253.03 -Tehnologia băuturilor alcoolice şi nealcoolice.

Scopul şi obiectivele lucrării: scopul lucrării constă în perfecţionarea tehnologiei de corectare a conţinutului de alcool în vinurile albe şi roşii seci prin metoda distilării sub vid. Obiectivele sunt următoarele: elaborarea regimurilor tehnologice optimale pentru corectarea conţinutului de alcool în vinurile prin metoda distilării sub vid, studiul influenţei procesului de dealcoolizare asupra indicilor fizico-chimici, complexului volatil, notei organoleptice a vinurilor obţinute; stabilirea influenţei acestui proces tehnologic asupra stabilităţii vinurilor albe şi roşii.

Noutatea şi originalitatea ştiinţifică lucrării constă în argumentarea ştiinţifică a tehnologiei de ameliorarea calităţii vinurilor albe şi roşii seci prin corectarea gradului alcoolic cu utilizarea metodei de distilare sub vid. Argumentarea ştiinţifică se bazează pe rezultatele cercetărilor teoretice şi experimentale, care denotă stabilitatea complexului volatil studiat, variaţia compoziţiei fizico-chimice şi ameliorarea calităţii senzoriale ale vinurilor cu grad alcoolic corectat. Noutatea ştiinţifică a lucrării este confirmată de brevetul de invenţie „Procedeu de obţinere a vinurilor naturale” (Hotărîre pozitivă, AGEPI, Nr: 8266 din 17.11.2015).

Problema ştiinţifică soluţionată constă în stabilirea şi argumentarea corelaţiei dintre parametrii procesului tehnologic de dealcoolizare a vinului şi conţinutului de alcool în produsul final cu grad alcoolic corectat. Corelaţia determinată este exprimată prin ecuaţii de regresie pentru vinul alb şi roşu.

Semnificaţia teoretică şi valoarea aplicativă a lucrării: În baza cercetărilor efectuate, referitor la metodele de producere şi ameliorarea calităţii vinurilor obţinute în urma corectării conţinutului de alcool, au fost elaborate scheme tehnologice de fabricarea vinurilor cu grad alcoolic corectat şi parametrii procesului tehnologic de producere a vinurilor albe şi roşii naturale cu grad alcoolic corectat.

Implementarea rezultatelor ştiinţifice: Rezultatele cercetării au fost testate şi implementate în condiţiile fabricii de vinuri ÎM„Nectar S” SRL prin producerea unor loturi de vinuri cu concentraţia alcoolică corectată, în volum de 2000 dal după schema tehnologică perfecţionată.

АННОТАЦИЯ

Столейкова Светлана «Технология производства сухих вина на основе корректирования содержания спирта». Диссертационная работа на соискание ученой степени доктора технических наук, Кишинэу, 2015 год. Диссертационная работа состоит из 4 глав, выводов и рекомендаций, библиографического списка из 194 источника, 9 приложений, 111 страниц основного текста, 32 таблиц, 27 рисунков. Результаты исследований представлены в 12 публикациях.

Ключевые слова: вино, содержание спирта, деалкоолизация, качество.

Специальность: 253.03- Технология алкогольных и безалкогольных напитков

Цель и задачи работы: цель работы заключатся в совершенствовании технологии корректировки содержания спирта в винах методом вакуумной перегонки. Задачи исследования: разработка оптимальных технологических режимов для корректирования содержания спирта в винах методом вакуумной перегонки; изучение влияния процесса деалкоолизации на физико-химические, органолептические показатели, а также на ароматический комплекс полученных вин; изучение влияния данного технологического процесса на стабильность белых и красных вин.

Новизна и научная оригинальность заключается в научном обосновании способа повышения качества белых и красных сухих вин путем корректирования содержания спирта методом вакуумной перегонки. Научное обоснование основывается на результатах теоретических и экспериментальных исследований, которые показывают стабильность изученного летучего комплекса, вариация физико-химического состава и улучшение вкусовых качеств вин с корректированным содержанием спирта. Научная новизна работы подтверждена патентом на изобретение «Способ производства натуральных вин» (Положительное решение, AGEPI, Nr: 8266 от 17.11.2015).

Теоретическая значимость и научная ценность работы. На основании проведенных исследований о методах производства и улучшения качества вин, полученных корректированием содержания спирта, были разработаны технологические схемы производства вин с корректированным содержанием спирта, а также параметры технологического процесса производства белых и красных натуральных вин с корректированным содержанием спирта.

Научная задача, рассматриваемая в диссертации, заключается в разработке и научном обосновании корелляции между параметрами технологического процесса деалкоолизации вин и содержанием спирта в конечном продукте. Определенная корреляция выражена уравнениями регрессии для белого и красного вина.

Внедрение научных результатов. Результаты исследований были проверены и внедрены на заводе ÎM„Nectar S” SRL путем производства экспериментальных партий белых и красных вин с корректированным содержанием спирта в объеме 2000 дал согласно усовершенствованной технологической схеме.

ABSTRACT

Stoleicova Svetlana «Technology of dry wines production on the base of alcoholic content correction». Doctor of engineering thesis, Chisinau, 2015. The thesis consists of introduction, four chapters, conclusions and recommendations, bibliography with 194 references, 9 anexes, 111 pages of basic content, 32 tables, 27 figures. The results were presented in 12 scientific publications.

Keywords: wine, dealcoholization, alcoholic content, quality.

Specialty: 253.03 - Technology of alcoholic and non-alcoholic beverages.

Purpose and objectives of research. The main purpose of the thesis consists in perfection of technology for correction of alcoholic content in dry white and red wines using vacuum distillation method. Objectives of research: elaboration of optimal technological regimes for correction of alcoholic content in wines using vacuum distillation method; study the influence of ethanol removal process on physical and chemical composition, organoleptic properties and on volatile complex of obtained wines; study the influence of ethanol removal process on stability of white and red wines;

Scientific novelty and originality of the thesis consisits in scientific substantiation of the method for amelioration of the quality of white and red dry wines by alcoholic content correction using vacuum distillation method. Scientific substantination is based on the results of theoretical and experimental investigations, which denotes the stability of volatile complex, variation of physical-chemical stability of wine composition as well as amelioration of the sensory properties of wines with corrected alcoholic content. Scientific novelty is confirmed by favourable decision of patent issuance "Method for obtaining of natural wines" (AGEPI, Nr: 8266 from 17.11.2015).

Theoretical significance and practicality applied value. On the base of the complex study regarding the methods of production and improvement of the quality of wines obtained by correction of alcoholic content, technological schemes for production of wines with corrected alcoholic content, parameters of the technological process for production of natural white and red wines with corrected alcoholic content was elaborated.

Scientific challenge solved within the thesis consists in elaboration and argumentation of the correlation between parameters of technological process of dealcoholization and alcoholic concentration in the final product with corrected alcoholic content. Correlation determined is expressed by regression equations for white and red wines.

Implementation of scientific results. On the base of obtained scientific results was tested and implemented, in production conditions at the winery "Nectar S" LTD experimental batches of white and red wines with corrected alcoholic content was obtained in the volume of 2000 dal according to the elaborated technology.

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253.03 –TEHNOLOGIA BĂUTURILOR ALCOOLICE ŞI NEALCOOLICE

Autoreferatul tezei de doctor în ştiințe tehnice

CHIŞINĂU, 2015

STOLEICOVA SVETLANA

TECHNOLOGY OF DRY WINES PRODUCTION ON THE BASE OF ALCOHOLIC CONTENT CORRECTION

253.03 TECHNOLOGY OF ALCOHOLIC AND NON-ALCOHOLIC BEVERAGES

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