On the study of the scientific basis for the use of products of processing of oak wood in the wine industry of the Republic of Azerbaijan

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Abstract

In all countries where viticulture and winemaking are developed, cognac production occupies a special place in the alcohol industry, with specific features. The individual characteristics of this drink are formed due to many factors based on soil and climatic conditions, applied agrotechnical measures and features of production technology. Currently, the world is modernizing the material and technical base of cognac production, enriching the raw material base, improving the quality and rational use of auxiliary materials, selecting and identifying grape varieties, developing new technological methods for improving the organoleptic and physico-chemical properties of cognac, and improving methods of its production. Increasing competitiveness and economic efficiency is an urgent task. However, in the formation of the quality of cognac wine material, cognac alcohol and cognac, important factors in the creation of advanced technology for the production of cognac are the characteristics of the grape variety, the place of its cultivation and soil and climatic conditions. For the production of high quality cognac, first of all, it is necessary to produce cognac wine material that meets modern requirements. Due to the relevance of these issues, in recent years, extensive research has been carried out in many countries of the world, identifying and applying modern methods and technologies to ensure the high quality of cognac wine material, cognac spirit and cognac, chemical components that meet modern requirements.. The development of new methods and technologies for improving the quality of cognac products is a priority in improving the quality of cognac and cognac spirits.

Keywords: wine industry, Azerbaijan Republic, oak tree, oak wine barrel

Introduction

Botanical classification and biological characteristics of oak species common in Azerbaijan

Oak forests make up 23.4% of Azerbaijan's forest cover. Oaks grow in the wooded parts of the Greater and Lesser Caucasus and on the slopes of Lankaran. Oaks are on average 75-90 years old, medium quality - III, medium thickness - 0.47%. The low average thickness of the oak is due to the presence of

large areas with a sparse cover.

Half of the total reserves of oak material in Azerbaijan (49.0%) are mature and old trees, most of these reserves are concentrated in the mountainous part of Lankaran and the Lesser Caucasus.

In the temperate and tropical countries of the Northern Hemisphere, the genus Quercus - includes about 600 species. About 65 of them are distributed in Europe and 20 in the CIS. There are also 17 species in the Caucasus. There are 5 types of oak forests in Azerbaijan. There is very little information about the Azerbaijani oak in literary sources. In his work, XXSteven described 5 species of Caucasian oaks growing in Azerbaijan: *G. longipes Stev., G. erucifolia Stev., G. Iberica Stev., Q. hypo chrysa Stev. and Q. crispata Stev. Oaks* are described by Yu.S. Medvedev in his work "Caucasian Oaks" (1908), which is fully included in the book "Trees and Shrubs of the Caucasus". Azerbaijani oaks are also described in the works of I. I. Karyagin (1930), Yu. N. Voronov, A. G. Dolukhanov, A. A. Grosshein, V. P. Maleev, N. N. Lebedev and others. A.A. Grossheim in his book "Flora of the Caucasus" speaks of the presence in the country of nine species of oak: *G. castatieifolia CAM, G. macranthera F. et M., G. araxina (Trautv) A. Grossh., G. longipes Stev., G. erucifolia Stev., Q. iberica Stev., Q. hypochrysa Stev., Q. crispata Stev. and Q. pu bescens Willd.* [*Bondarev, 2001, p.151*].

Systematically and geographically commented on the Caucasian oaks in the study of the genus Quercus for the Flora of the USSR. He made changes and additions to the existing gender system. In addition to the oak species shown by A.A. Crossheim, G. pedunculiflora , Q. crispata Stev. the type is considered a variety of root oak.

Of the oaks growing in Azerbaijan, the physical and mechanical properties of only chestnut-leaved oak have been studied. Oak wood and bark contain tannins that contribute to the tanning of the skin. In addition, chestnut oak, long-stemmed oak, Georgian oak, sagging oak can be used for landscaping. More than nine species of oaks grow wild in the forests of Azerbaijan: *Quercus castanefolia CAMeyer - chestnut-leaved oak; Q. machanthera Ficher et Meyer – oriental oak; Q. araxina (Trautvetter) A.Grossh. - araz oak; Q. longipes Steven - long oak; Q. iberica Steven - Georgian oak; Q. erucifolia Steven - wide oak; Q. hypochrysa Steven - red oak; Q. crispata Steven - curly beans; Q. anatolica (Schüarz) D. Sosn.* - There is a hanging shaggy oak.

The first five types are formed by breeds in forests, and the rest are mixed. Only two of these types of oak, oriental oak and Georgian oak, are highly valued for making wine barrels. Rarely is there a board for a wine barrel made of chestnut leaf oak. Other local oak species are almost never used for winemaking.

Q. castaneifolia. SAMeyer - chestnut oak - a large tree with gray, grayish-brown bark, up to 28-40 meters high. It occurs as shoots in forests and in places where trees are cut down.

Distribution: It is the main forest-forming tree species in the Lankaran mountain system and is found both in lowland and mountainous areas at an altitude of 1300 m above sea level and in the Ismayilli region. Tertiary mesophilic - a representative of the forest flora. Distributed in the Caspian part of Iran in the south. This is a valuable tree for

afforestation in the treeless regions of the southeastern part of Azerbaijan. In 1937 and 1939, oaks were planted for experimental purposes in the Yalama forestry of the Khudat district, and the plantations grew well. According to Z.A. Novruzova (1952), chestnut-leaved oak wood has positive physical and mechanical properties. Chestnut-leaved oak is about 240 years old, 36 meters high, trunk diameter 1.3 meters.

Q. macranthera Ficher et Meyer – oriental oak or coarse grain oak This tree is up to 28 meters high. It has branches hanging down to the ground and brown, cracked bark.

Distribution area: in mountainous areas, 1400–2550 m above sea level , in the upper forest belt, forest is one of the main species of creative trees. This is the predominant forest formation on the southern slopes. Distributed in the north from the North Caucasus to the Stavropol Territory, in the west - in Georgia and Armenia, in the south - in Turkey and Iran.

Economic value. Drought and frost resistant. The annual amount of precipitation is 370-400 mm, the average temperature in January-February is 8-9°C, the absolute minimum temperature in summer is 28-29°C. The wood is stronger and more durable than other types of oak. Wine barrels are valuable for making planks.

Trautvetter A.Grossheim - Araz oak. This tree is up to 18 meters high. Its six forms have been identified by Aaq Rossheim.

Distribution area: Zangilan is located in the forest part of Gubadli region, at an altitude of 500-1100 meters above sea level. In the lower reaches of the mountains, together with other tree species, it forms sparse arid forests. It occurs in the southern part of the Nakhchivan Autonomous Republic.

Economic value. Drought resistant. It was not used for the production of wine and cognac barrels.

Q. longipes Steven - long oak Its height reaches 40 meters. Shoots greyish-brown, glabrous.

Distribution: This is one of the forest-forming tree species in lowland areas. Forms tugai forests around rivers, but sometimes can climb mountains up to 700 meters above sea level.

Economic value. Drought resistant. The annual rainfall is 290-300 mm, it grows well in January-February at an absolute minimum temperature of 17ºC, and in July-August at a maximum temperature of +37ºC. Wine and cognac barrels were not used for industrial production.

Q. ericifolia Steven – broadleaf oak This tree is up to 20 meters high.

Distribute. It occurs in the mountains at an altitude of 500-1500 meters above sea level in the Guba, Sheki and Khojavend regions. It is of limited economic importance due to its low prevalence. It is not cultivated. Wine and cognac barrels were not used for industrial production.

Q. iberica Steven - Georgian (Iberian) oak. This tree is up to 32 meters high.

Distribution. It grows in all forests in the north of the country, in the North Caucasus at an altitude of 300-1700 meters above sea level. It varies in many respects.

Economic value. It occupies the largest place among all types of oak and is of great economic importance. The ore of the bark

and cones is used in the production of beverages. It is used in the production of wine and cognac barrels.

Q. hypochrysa Steven - Golden leaf oak. It has a height of up to 30 meters. Q. iberica is close to Steve.

Distribution area. Distributed in Gusar, Guba, Shabran, Ismayilli, Gabala, Oguz, Khankendi, Lankaran and Lerik regions at an altitude of 500-1700 meters above sea level.

Economic value. Like before. Not found in cultural event.

Q. crispata Steven - Oak curly or curly. This tree is up to 12 meters high.

Distribution area. Khudat grows in mixed conditions in the Gusar regions at an altitude of 500-1000 meters above sea level. Distributed in Dagestan, Crimea and Krasnodar Territory. There are no cultures.

Q. anatolic (Schwartz). D. Sosnovsky - Shaggy oak. Tree height up to 12 meters.

Distribution area. It grows in Khudat, Khachmaz, Shabran and Guba regions at an altitude of up to 500 meters above sea level.

Economic importance is limited. There are no cultures.

Table 1. The reserve of Azerbaijani oak forests according to the height of the quality classes

Age (years)	I am Bonite		II Bonite		III Bonite		IV Bonite		In Bonita	
	Average height (m)	Stock of trees per hectare (m^3)	Average height (m)	Stock of trees per hectare (m^3)	Average height (m)	Stock of trees per hectare (m^3)	Average height (m)	Stock of trees per hectare (m^3)	Average height (m)	Stock of trees per hectare (m^3)
one	2	3	4	5	6	7	eight	nine	ten	eleven
20	7.6	108	6.5	81	5.6	55	4.0	42	2.3	thirty
thirty	12.0	162	9.8	123	8.3	84	5.8	63	4.5	45
40	15.1	216	13.3	165	11.1	113	7.7	84	6.0	62
fifty	19.0	270	16.0	207	13.6	142	9.8	105	7.4	79
one	2	3	4	5	6	7	eight	nine	ten	eleven
60	22.2	323	18.8	248	15.8	171	11.5	126	8.8	96
70	25.3	373	21.0	282	17.7	200	13.8	147	10.3	113
80	27.7	403	22.8	315	19.4	228	15.3	168	11.7	130
90	29.4	428	24.5	345	20.8	255	16.8	189	13.0	147
100	31.0	448	25.8	368	22.0	280	17.8	210	14.0	164

110	32.0	466	26.7	389	22.8	298	19.0	230	15.0	180
120	32.5	483	27.4	409	23.6	315	19.7	246	16.0	196
130	32.6	496	27.7	425	24.0	330	20.3	260	16.5	209
140	32.7	508	27.8	439	24.3	345	20.8	273	17.0	221
150	32.8	520	28.0	451	24.3	357	20.8	286	17.5	232
160	32.8	530	28.0	462	24.3	368	20.8	298	17.5	239
170	32.8	540	28.0	471	24.3	377	20.8	310	17.5	246
180	32.9	550	28.1	479	24.3	385	20.8	318	17.6	251
190	33.0	560	28.2	485	24.5	393	20.8	325	17.7	256
200	33.2	565	28.3	490	24.6	400	20.9	330	17.8	261
210	33.4	570	28.4	495	24.7	405	21.0	335	17.9	265
220	33.5	575	28.5	500	24.7	410	21.0	340	18.0	268

Large reserves of mature and old trees have been accumulated in the oak forests of Azerbaijan. To study oak plantations on an area of 89.6 ha of chestnut-leaved oak (Q. castaneifolia CAM), ascending oak (Q. macranthera F. et M.), elongated oak (Q. longipes Stev.) and Georgian oak (Q.iberica Stev.) 40 test sites were used. There is no large - scale deforestation in Azerbaijan.

So, in the forest belt of the Lankaran mountain system, old oak plantations are - found in Astara (67.0%), Lankaran (13.1%) and 8.4% Masally forestries. There are no first-class young stands in the Astara forest areas. The area of young growth of the second grade is 3.0%. The average quality of class III oak forests is 4. Low quality accounts for 47.7% of crops. I and II bonds are 20.3%. The average density of oak crops is 0.47%. Crops with a density of 0.8 or more make up only 34.0% of the forest cover area of the Greater Caucasus. In the mountainous region of the Lankaran mountain system, densely populated stands are located mainly in the Lankaran and Masally forestries (7.0%). Low-growing crops are found in Astara (25.7%), Lankaran (14.0%) and Masally (17.4%) forest areas.

The total stock of firewood in oak plantations is 18.6% of the total forest resources. Forest reserves of mature and old crops (49.0%) make up 60.0% of the Lesser Caucasus and 61.9% of the Lankaran region.

The area of mature and old crops in the forest region of the Greater Caucasus is 22.4%. In the Zagatala forestry, such crops are more common (43.8%). There are no mature and old oak plantations in the Guba, Gusar and Yalama forestries. In the forest cover of the Lesser Caucasus, the resources of mature and old trees are located in Agdara (99.4%), Khojavend (88.9%), Lachin (60.1%) and Khankendi (40.9%) forest areas. There are no such reserves in Tovuz, Gadabay, Nakhchivan, Barda and other forestries. Along the Lankaran mountain system, mature and

aged wood resources are found in Astara (77.8%), Lankaran (62.9%) and Masally (52.8%) forests. Most of the wood is found in the oak forests of the Lankaran mountain system. The high stocks of wood along the Lankaran mountain system are explained by its age, quality and oak content compared to other forest plantations.

The distribution of oak forests in Azerbaijan by quality classes, and the latter by age classes, is shown in Table 1. On the experimental plots, the indicators of the areas of intersection of high-density oak plantations were determined according to the quality classes in fully consolidated oak forests. All total reserves were brought to a density of 1.0 according to these indicators and then equalized. Due to the lack of high-quality polygons, reserves were calculated by graph classes.

Botanical classification of oak species common in Azerbaijan and biological properties

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In the winery complex processing of oak wood products prospects for use

In recent years, in addition to the traditional use of oak wood as a tub and an idol, its other effective applications have also been mastered - thermal processing into fresh wines, calvados and cognac spirits [*Nabiyev, A. 2010*] microparch, sawdust, microfiber and oak ore are added. Due to the wide use of oak wood and the creation of a direct contact zone, the botanical type of oak, the degree of grinding and roasting, etc., have been improved optimal and efficient methods for the production of wines and cognacs from oak wood by controlling and regulating their properties.

Roasted oak wood gives drinks a specific aroma and taste, and the formation of these aromas occurs primarily due to cellulose and lignin, which during thermolysis form furan aldehydes (dry smell), phenoaldehydes (vanilla aroma), and volatile phenols [*Domarchev, 2004*].

Protea (France) produces several types of sawdust and microsawdust, which, depending on the degree of roasting of oak wood, give aromas of freshly sawn wood - aromas of coconut, exotic fruits, toast, almonds, coffee, chocolate, etc. [*Gomonay, 2002*]. Particular attention of researchers is paid to special methods, which are based on the addition of oak ores obtained according to various technological schemes for growing young cognac spirits [*Fataliyev, H. 2011*]. Oak ores are obtained by water or water-alcohol extraction of wood or using a crushed type of oak [*Goroshin, S. 1953*].

In such cases, specific vanilla flavors and fruit tones predominate [*Korovin, V. 2007*]. To speed up production in the wine industry, it is recommended to use oak ore [*Reznchenko K; Osledtseva I; Guguchkina T. 2012, p.30*]. In all proposed ways of using oak ores , temperature, alcohol concentration, pH value and other factors often contribute to the formation of some unpleasant components,

resins, paraffins, macromolecular compounds, etc. causes extraction.

Aging of wine products stored in oak barrels grade

The degree of maturity of cognac spirits lies in the appearance and formation of specific properties at the dormant stage. At this stage, as a result of the interaction of oak wood with cognac alcohol, the processes of esterification, saponification, and others occur. As a result of these processes, new components are formed [*Lukanin A., Panakhov T., Bratko D., 2013*]. The assessment of the end result in the aging process consists in determining the compliance of cognac spirits, cognacs and wines aged in oak barrels with the requirements of the relevant regulatory and technical documents (GOST R 51145-98 Cognac spirits. Specifications , GOST 31732-2014 Cognacs. saved).

In the second half of the 20th century, the development of cognac and cognac spirits in large tanks with oak staves in the CIS and Azerbaijan led to the search for new ways to assess the quality of the drink and its age using instrumental analysis methods. At the same time, attention was paid to the level of concentration of substances (vanillin, jasmine, mercury, and coniferous aldehydes) formed during the transformation of lignin [*Pisarnitsky A.F., Egorov I.A., Egofarova R.Kh.* 1979]. However, these components do not fully reflect the entire spectrum of oak aromatic components, which turn into cognac spirit during storage, and therefore cannot be considered as the final version of its quality assessment.

Treatment of diseases and elimination of defects in wine and cognac

There are so many different wines on the local market that in some cases they have certain diseases and deficiencies. The most common of these are excessive oxidation of wine - oxidase casts, hydrogen sulfide tone or "suffocation", metal shells [*Lukanin; Panakhov T; Sideorenko; Zrajva S., 2013*]. The most common disease is the insufficiency of "mouse tone", which is found in all types of wines, and the patient also turns to cognac spirits during the distillation of wine materials [*Lukanin A., Panakhov T., Sidorenko A., Zrajva et al. 2012*]. "Mouse tone" is attributed to diseases or deficiencies, since it is caused by physicochemical and microbiological changes or lactic acid bacteria (Bacterium mannitopoeum Muller-Thurgau, Oster valdera and lactobobacillus). It is formed as a result of the metabolism of microorganisms such as acetic acid bacteria, yeast bacteria (Pichia), yeast-like fungi (Brettanomys) [*Pisarnikstiy A., Yegorov I., Gavrilov I., 1979*].

These diseases are caused by excessive concentrations of oxidizing acids in wine, elevated concentrations of volatile acids, elevated concentrations of iron that catalyze redox processes (wine comes from technological equipment and containers made of ferrous metals and not corroded). The formation of mouse tone is accompanied by oxidative demineralization of amino acids , which leads to the formation of aldehydes and ammonia [*Carina P. Lang, Nikolaus Merkt, Christoph-Martin Geilfus, Simone Graeff–Hönninger, Judy Simon, Heinz Rennenberg & Christian Zörb, 2019*]. Where ethyl acetate is always present in wine, acetamide can form and develop a mousey tone. If wine, especially red wine, contains enough tannin, the oxidation-deamination reaction of amino acids proceeds without

ammonia, only with the formation of aldehydes (aminophenols are formed), and therefore a less mousey tone is observed [*Leigh M. Schmidtke, Andrew C. Clark & Geoff R. Scollary, 2011*].

The main reasons for the mouse tone are: contamination with microflora, low acidity, high redox potential of wine materials. Exposure to active oxygen, excessive ventilation , high concentration of iron, pH above 3.4 can cause the formation of mouse tone. The appearance of mouse tone is observed when the redox potential is within rH2 20-26.

Physico-chemical indicators of the tone of mice are also determined by the grape product. With better maturation, the accumulation of sugars leads to a decrease in titratable acids, an increase in pH, and also to the accumulation of amino acids such as proline, glycine, ornithine and lysine, inhibitors - glutamic acid and its amide. mice contributes to the formation of mouse tone immediately after fermentation.

As a result of Nemtsova's research, it was concluded that mouse tone is formed as a result of a complex redox reaction occurring at a high redox potential (460-550 mV), in this case it is possible that it is formed as a result of the activity of enzymatic microorganisms. Adding a 1–2% alkaline solution to wine increases the tone of the mouse, which facilitates its identification [*Maria del Alamo-Sanza & Ignacio Nevares, 2018*].

Oxidative deamination of amino acids occurs with greater contact with oxygen, and in the presence of ethyl acetate, acetamide or excessive oxidation leads to "mouse tone". Mouse tone causes a significant increase in wine amide nitrogen, ammonia in the form of ammonium salts, acetaldehydes, acetals and ethyl acetate.

It is known that ammonia reacts predominantly with aldehydes, acetals, and ethyl acetate to form acetamide. When alkali is added to wines that do not contain ammonia, acetamide tastes the same as wines containing ammonia and aldehydes. When alkali is added to wines containing a significant amount of ammonia and aldehydes, the pH reaches 9.5-10.0. Eh 625 mB, wine oxygen is absorbed up to 26.9 cm and the taste of acetamide is formed.

Acetamide is the final solution in this series of reactions. Small doses of hydrogen peroxide cause an acetamide taste, and large doses destroy this taste. For this reason, the substances that create mouse tone are oxidized. Substances that create tone in redox processes are intermediate products. Adding azotamidine to wine does not cause this deficiency. The physicochemical formation of a mouse tone depends on the concentration of iron pH and rH2 in the wine.

At pH 4.0, the content of iron (Fe) during fermentation of 40 mg/dm and more and aeration of wine with a low content of phenol (190 mg/dm ^{2}), a mouse tone may appear in the wine material, i.e. 5-10 mg/dm3 oxygen ^{3} activity time.

As the pH of the wine rises, lactic acid bacteria develop. With an rH2 value of 21-25, an excess of mouse tone is observed in the wine.

It is known that wines do not have a mouse tone at rH2 of 25, but have an oxidized wine taste. In addition to the complexity and durability of traditional processing methods,

significant losses of wine materials are characteristic to overcome the shortcomings. It is characterized by energy and reserve intensity, which leads to an increase in the cost of finished products and does not always have a positive effect [*Panakhov T., Lukanin A., Zrejva S. 2014*].

oak wood processing products to eliminate wine defects and diseases, especially mouse tone, have not been previously studied, and therefore promising in the technological processes of winemaking. The main hypothesis for this is the enrichment of wines with phenolic and aromatic components of oak wood with the possible adsorption of components that give the wine an unpleasant smell and taste.

Substantiation of the results and objectives of the study

As a result of the study of literary sources, it was found that Azerbaijan has a relatively small potential, and Ukraine has the potential for large reserves of raw oak. In terms of quality indicators, the wood of the Azerbaijani and Ukrainian oak is not inferior to the oak wood of the leading countries in the production of tubs. The massive export of oak from Ukraine, and recently from the Azerbaijani Lachin forests to the censers of France, Germany, Spain and Portugal, is a vivid confirmation of this [*Tierney Bocsi, Richard W. Harper, Stephen DeStefano & Daniel A. Lass, 2021*].

raw material resources of oak wood in different regions of Azerbaijan and the development of selection criteria for stumps (beams) for the production of oak planks tub production in Azerbaijan cannot develop and compete with European manufacturers.

The technology of preliminary preparation (drying-growing) of oak boards for use in cask production and large tanks in which wine distillates are grown is currently used in many CIS countries in cask production, factories for the production of fine wines and cognacs. However, this technology is imperfect and the process of drying and growing itself needs to be updated and improved in order to optimize the biochemical and chemical processes occurring in the wood.

The imperfection of the interstate standard GOST 247-58, approved in 2008 and currently applied to oak bark and wood, does not meet the requirements of the European Union, taking into account the need to optimize the dynamics of natural maturation of wood. technological process of drying oak wood. This, in turn, can pave the way for the efficient use of local raw materials and the production of competitive bathtubs. Azerbaijan's wine industry needs to upgrade its oak barrel park to produce competitive wines and cognacs. The stocks of raw oak wood in Azerbaijan in terms of quantity and age meet the requirements for oak wood for the production of wine and distillate barrels.

The regulatory documents in force in Azerbaijan for the production of oak wood and tubs do not meet the criteria for selecting high-quality firewood.

The integrated use of oak processing products (rivets, micro-rivets, sawdust, micro-sawdust) makes it possible to effectively use the raw materials of oak in the country for the wine industry.

The prospects for using oak processing products as an alternative to oak barrels in winemaking determine the expediency of studying the output balance of products made

from oak wood.

at the Research Institute of Viticulture and Oenology of the Ministry of Agriculture of the Republic of Azerbaijan together with the staff of the Laboratory for monitoring raw materials for wine of the Institute of Agroecology and Nature Management of the Academy of Sciences of Ukraine.

In order to study the balance of complex processing of oak stumps at the production base of the Goychay ATPK, experimental studies were carried out on the complex processing of oak timber for the production of tubing boards. Studies on the use of oak for the production of tubs were carried out at the Goychay brandy factory ATSK.

Approbation of the developed technology for the use of oak processing products in the cultivation of cognac spirits in old spent barrels and large containers was carried out in 2014 at the Goychay Brandy Factory ATSK.

Approbation of methods for drying and growing oak rivets for wine and cognac barrels in open and closed stacks was carried out in 2009-2011 in the Agstafa region at the Moshu ATPC under production conditions.

The technology for the use of crushed oak wood, based on the use of oak processing products, for the treatment of diseases and the elimination of defects in wine was tested in 2011 at Khachmaz APC.

Characteristics of study materials

1st, 2nd and 3rd 3-5 m long, selected for research from Agstafa, Shamkir, Astara, Lankaran, Yardimli, Lerik, Khachmaz (Khudat, Yalam), Shamakhi, Ismayilli, Sheki and Barda regions of Azerbaijan. from oak beams. For comparison, oak samples taken from the Kiev Regional State Forestry Enterprise were also used.

To assess the yield of oak processing products from stumps, they were complexly processed and crushed, taking various products: rivets, micro-chips, sawdust, micro-sawdust, sawdust.

The selection of oak beams and their experimental felling were carried out in state forestry enterprises.

The diameter of the stumps ranged from 46-88 cm. Curvature stumps in type 2 and type 3 stumps were removed by sawing pieces of wood 1 meter long. To determine the natural direction of the fibers in these pieces of wood, they were cut into 4-6 pieces using a vertical hydraulic axe. Torn off parts were sawn parallel to the cutting plane on a machine with a band saw. The resulting rivets were cut lengthwise and widthwise on machines equipped with a circular saw. Pieces of wood have already been cleaned of existing defects, tops and knots and processed into sawdust and micro-sawdust on a chipper.

The main task of the tubing industry is to ensure the efficient use of various oak processing products for the production of wines and distillates, as well as the conservation of environmental and raw materials.

the yield of wood suitable for the manufacture of tubs, as it is the most valuable product and the main requirement for its quality is the absence of cracks and knots.

Selection of oak and its experimental felling were carried out in Azerbaijan and in the state forestry of the Kiev region. The material

for the research was distillates from young wine made from Rkasiteli grapes and processed oak wood, which were tested in production tanks at the Goychay Cognac Factory APC in tanks with a capacity of 1500 tons.

Properties of wine materials and cognac spirits as a research material

The research material was young cognac spirits made from oak and Rkasiteli grapes, aged in new and old barrels and tanks with a capacity of 1500 compartments with oak boards and other oak processing products.

Other research materials were processed and crushed to varying degrees: longleaf oak (Q. robur L.), beech oak (Q. macranthera F.etm), chestnut leaf oak (Q. castaneifolia CAM), Georgian oak (Q. iberica Stev.), Araz oak wood (Q. araxina Trautv).

The research material was a natural and heat-treated rivet, microchips, sawdust, microsaw, prepared according to TU 19412998.001-99. For experiments with cognac spirits, oak rivets were used at a level of 76 cm ^{2} /dm ^{3} when growing spirits in tanks, which corresponds to the specific area of the inner surface of a barrel with a capacity of 350 dm ^{3} ; natural and heat-treated small oak shavings were taken at the rate of 0.25...20.8 g/dm ^{3} , which corresponds to the surface of an oak board on the inside of the barrel impregnating cognac alcohol to a depth of 1.0... 4.0 mm.

In studies to eliminate the consequences of the "mouse tone" defect in wine, the wine materials "Rkasiteli", "Savignon" and "White Port" were used. The studies were carried out in triplicate. The selection and evaluation of hospital wine materials was carried out by the organoleptic method. Wine materials with diseases are processed with oak wood in accordance with KSVP-5-2000 "Technological instructions for the use of split oak wood in the production of wines, cognacs and dark drinks". The effectiveness of the operation was determined by the main physicochemical and organoleptic parameters. Control samples were diseased and defective wine materials. The products of the local and German company "Düler" were used as auxiliary materials in the development.

Local preparations:

Citric and tartaric acid, bentonite, natural and thermally processed microalgae less than 0.1x2.0x1.0 mm in size, manufactured according to TU-U-19412998.001.

Preparations of the German company "Döler". Gerbinol super is a drug based on fish glue, milk protein and gelatin, used as an adsorbent. The drug is used at a dose of 3... 5 to 15-20 g / 100 dm ^{3} before filtering the wine into a glass (a 5% aqueous mixture is prepared for processing).

Boxin is a preparation based on processed silicate minerals. Used as an adsorbent. Easy to use as it is liquid. The recommended dose is 50...150 ml/100 dm $^{3.}$

Activated carbon grade B (BAU-B) or Granukol Qe is a preparation based on activated carbon of plant origin used as an absorbent. The recommended dose is 10...40 g/100 dm $^{3.}$

Kadefit is a preparation based on potassium metabisulphite. Used as an antioxidant, antiseptic. Recommended dose for pulp grinding: 5...15 mg/100 dm3 , for juice sulfiding $^{10.}$..40 mg/100 dm3 , for wine sulfiding (in - technological operations) - 30...50 mg/100 ^{dm3} there is.

Experimental methods

Depletion Criteria for Reusable Oak Bathtubs

The study was carried out according to the scheme shown in Fig. 1.2 (p. 69). Evaluation of the dynamics of the depletion of fresh oak barrels after repeated use, the study of the chemical composition of cognac spirits after each storage period (determination of the concentration of oak components that have passed into alcohol during cultivation) in comparison with the empirical data of classical technology, according to the results , cognac spirits were stored in oak barrels from 1 to 5 years. The growing period was 1 year (pouring young cognac spirit into the barrel → aging in the barrel for 1 year → emptying the barrel → analysis). The duration of the experiment is 5 periods, 5 years. In 2008, young cognac spirits made from Rkasiteli grapes were used for the experiment. This cognac spirit was kept in a closed container for 2-5 periods before bottling without contact with oak (for the purity of the experiment).

Development of criteria for evaluating the maturity of ordinary cognac spirits when grown in oak barrels.

The criteria for evaluating maturity when growing cognac spirits in oak barrels is based on the correlation between the shelf life of spirits in barrels (an indicator of age) and their enrichment with oak wood components during this period.

These components are registered as markers and are phenolic and aromatic substances of oak wood (scopoletin, eugenol, vanillin, trans-cis-β-methyl-γ-octalactone) [*Si-Yu Li & Chang-Qing Duan, 2019*] .

According to the International Classification of Oak Wood used in winemaking, these substances are the main indicators of the quality of oak wood. Cognac spirits were aged in oak barrels with a capacity of 350 dm $^{3\text{ for }5}$ years. The equation for calculating the aging index of cognac spirit was created using the program of statistical data processing (Excel). The coefficients of the equation for determining the age index of cognac spirit are the preparation for each component under study, based on the decrease in its concentration in oak wood (wood depletion).

The value of the age index was calculated as the average value of the reproduction index prepared for each studied component.

Result

Unlike the traditional method of storing cognac spirits in oak barrels or large metal containers covered with special enamel inside, the features of the new cognac production technology based on the use of oak processing products characterize the physicochemical composition of cognac spirits. cognac spirit (Fig. 5.3) and organoleptic evaluation. The costs were calculated during production tests of the developed technology using oak processing products. Of sawdust introduced when cognac alcohol comes into contact with sawdust of oak of medium fraction is 8 g/dm). % at an amount of 6.0 g / dm ^{3} , 0.9% at 8.0 g / dm ^{3} and 1.25% at 10.0 g / dm $^{3).}$ Thus, production tests confirm the effectiveness and expediency of using oak wood processing products in the production of cognac (brandy). This makes it possible to improve the quality of drinks and ensure their competitiveness through the use of old, used barrels available at wineries.

The developed new technology for the use of oak processing products in the cultivation of cognac spirits in obsolete barrels and large tanks was recommended by the commission for wide use in cognac production.

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