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DEVELOPMENT OF A TECHNOLOGY OF OIL MADE FROM SEEDS OF GRAPES CULTIVATED IN THE ODESA REGION WITHOUT LOSING THE QUALITY CHARACTERISTICS

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Abstract. It has been studied whether seeds of Odessa Region-grown grape varieties Lydia, Moldova, Cabernet, and the blend Muscat Blanc + Noah (50:50) are promising raw materials for fat-and-oil products and cosmetics. The study provides a scientific basis for a technology of oils from a number of varieties of the region's grape seeds. For seeds from different grape cultivars, appropriate process conditions have been selected to obtain extra virgin oil by cold pressing. The most practical conditions for wet-heat treatment of crushed Cabernet and Moldova seeds are the temperature 30–40°C and duration 5–10 min, and seeds of Lydia and the blend Muscat Blanc + Noah (50:50) should be treated, at the same temperature, for 15–20 min. When extracting oil by pressing, it is recommended to avoid heating the treated crushed seeds (extraction mash) to over 50–60°C for more than 5–7 min. The research results have shown that the oil content in the seeds of the Lydia, Moldova, and Cabernet grapes, and of the blend Muscat Blanc + Noah (50:50) is 14–20%. The suggested process conditions of producing oils allow the maximum retention of the initial fatty acid and phenolic composition of raw materials. It has been proved that in oil from Lydia seeds, the content of ω-6 fatty acids is 99.5%, and that of ω-9 fatty acids is 96.2% of their initial content in raw materials. In oil extracted from Moldova seeds, ω-6 fatty acids make up 99.6%, and ω-9 98.2%, in oil from Cabernet, ω-6 make up 98.6%, and ω-9 93.7%, and the blend Muscat Blanc + Noah (50:50) contains ω-6 and ω-9 in the amount, respectively, 98.5% and 97.1% of their initial content in raw materials. It has been proved that oil extraction from seeds of different grape varieties should precede the extraction of phenolic compounds. In extracts from raw materials with oil pre-extracted under the process conditions suggested, the concentration of phenolic compounds is by 80–120% higher than it is in extracts obtained from native (untreated) seeds of different grape cultivars.

Keywords: grape seeds; technology of extraction by pressing; extra virgin; crushed seeds; grapeseed oil; grapeseed oilcake; fatty acid composition.

Introduction. Formulation of the problem

Fat-and-oil enterprises rank in the top five food industries by their production volumes [1].

The currently used technology of extracting useful components from grape seeds is based on pretreating them and pressing them on worm presses, with such operations involved as quick pomace drying, isolating seeds from pomace, purifying and separating seeds from admixtures, and drying the grape seeds till the residual moisture content is 11–12%.

Higher yields of grapeseed oil greatly depend on the thoroughness of crushing and the degree of destruction of the cellular structure. The hardness of grape seed coats is the main obstacle to efficient oil extraction. This research topic is of current importance, because efficient utilisation of grape processing by-products is a highly topical problem that needs further study [2].

Grape seeds (stones) make up to 30% of the volume of pomace obtained when manufacturing wine and juice. They are separated from the rest of the material, dried, and crushed in order to destroy the hard coating. This stage is directly followed by obtaining oil using a number of techniques [3].

Recent academic and practical studies by foreign and Ukrainian scientists have extended the range of applications of grapeseed oil as a fully functional component of foods and diabetic products. Besides, it is used in medicine and in the cosmetic industry.

All the above shows the prospective benefits of studying more closely different varieties of grape seeds, establishing their regional specific features, developing new technologies of obtaining fat-and-oil products from various grape seeds.

Analysis of recent research and publications

A priority line of development of the food, pharmaceutical, and cosmetic industries is a comprehensive technology of utilising by-products of grape processing [4].

A valuable and highly promising source is seeds of different grape cultivars containing beneficial nutritious and biologically positive substances [5,6].

A technology of obtaining fat-and-oil grapeseed products and their applications have been studied [7,8].

There are three methods of producing oil from grape seeds:

– Cold pressing. With this technology, oil retains most of its useful substances and trace elements. The temperature in the course of pressing must not exceed 90°C.

– Hot (standard) pressing. With this technology, oil retains almost no useful substances and trace elements, because it is extracted at very high temperatures, seeds being thermally treated at more than 110°C.

– Extraction with organic solvents followed by refining. Oil produced by this technology retains far fewer useful substances as compared with cold pressing.

So, these three methods (standard, or cold pressing and chemical extraction) are usually employed to produce grapeseed oil. Higher-quality oil for food purposes is obtained from processing grape seeds that are isolated from pomace at wineries and canneries in situ. To this end, pomace is immediately washed to get rid of extractives, dried till its moisture content is 11–12%, crushed roughly to separate the dry skins of grape berries, and then the released seeds are separated [9-13].

The classical method of obtaining grapeseed oil is press extraction [14-16]. The technology of processing grape seeds by pressing includes the following operations: removing alien weeds from seeds, conditioning seeds (if necessary, drying to the moisture level not more than 12%), pulverising seeds with smooth or ribbed rolls, preparation of grape mash in a heating vat, and compressing the mash on expellers providing single-time residual pressing. When grape seeds are pressed, the efficiency of the oil yield is determined by how finely they are comminuted and how deep the cellular structure is cleaved. Grape seeds are characterised by a specific structure, high huskiness, and hard-structured husks. That is why when crushed seeds are prepared for pressing, high moisturising is recommended (up to 16%) [17]. The oil obtained is green-coloured due to an increased chlorophyll content, an increased acid number, and an elevated level of oxidation products. It requires more stages of purification.

By its nutritiousness and composition, this oil is comparable with extra virgin oil, which is unrefined and thus retains all beneficial elements needed for human health. It can be used to treat and improve the general health of the whole body, or as a skincare and haircare product.

Some vital components (like vitamin E) are even present in grapeseed oil in larger amounts than in olive oil [18].

There is also a method of obtaining grapeseed oil by using chemical activation [19]. It involves crushing seeds and treating them with a reagent. The latter is glycine (aminoacetic acid), used in the form of aqueous solution in the amount 0.3–1.0% of the weight of crushed seeds, with continuous stirring for 3–5 min. The subsequent stages are wet-heat treatment and extraction of oil by pressing.

Still, a very important issue is developing technologies that allow extracting oil with but a milder technological impact on the raw materials. That is why today’s developers are more and more focusing on extractive methods of grape seed processing. The existent manufacturing schemes are based on extracting oils by means of such hydrocarbon solvents as petroleum ether, hexane, or other solvents with the equivalent boiling temperatures [20].

Seed oils from different grape cultivars grown in China were studied, and the difference in the stability of compositions of fatty acids and sterols was proved [2].

Oils from seeds of different red grape varieties cultivated in the autonomous communities Castile-La Mancha and Murcia (Spain) were investigated by determining the physicochemical and sensory quality parameters, the stability of the fatty acid and sterol composition. Besides, in the seeds of 17 grape cultivars grown in the main wine-producing regions of Castile and León (Spain), the flavanol composition was studied. Twenty-seven different procyanidin-type flavonoids were identified, but no prodelphinidins were found among them. Also, the grape cultivars analysed included tanning agents, but in small quantities. All the cultivars contained flavonoids, which can be considered characteristic of the compositions of grape seeds of different varieties [21,22].

Thus, the technology of obtaining oil from different grape seed varieties needs further development.

The purpose of the research is to develop a technology of obtaining oil from different Odessa Region-grown grape seed varieties, with the quality characteristics retained, by developing new process conditions, introducing new duration of pressing, studying the quality parameters, and retaining the fatty acid and phenolic composition.

The objectives of the research:

1. To study the quality parameters of different grape seed varieties.

2. To develop a technology of obtaining oil from different Odessa Region-grown grape seed varieties.

3. To study the fatty acid composition of the oils and the phenolic composition of the extracts.

Research materials and methods

The following cultivars characteristic of the Odessa Region were selected as the raw materials for oil: Lydia, Moldova, Cabernet, and the blend Muscat Blanc + Noah (50:50) harvested in 2020. This complies with DSTU (State Standard of Ukraine) 7546:2014.

The mass fraction of moisture was measured by the rapid method involving the single-time keeping of seeds in a drying chamber at a certain temperature and preset duration, according to DSTU 4811:2007.

The mass fraction of impurities and oil admixtures was determined according to DSTU ISO 658:2006.

The volumetric mass of the seeds was determined according to DSTU ISO 658:2006.

The length of a seed was determined according to DSTU ISO 658:2006.

The weight of 1000 seeds was measured according to DSTU ISO 658:2006.

Oil was obtained by cold pressing on a laboratory hydraulic press U1 EPM. Prior to pressing, the crushed grape seeds underwent wet-heat treatment in a bain-marie.

The mass fraction of moisture in the crushed material was measured by the rapid drying method or using an electrical moisture meter (according to DSTU ISO 771:2006).

The thickness of an oilcake was measured according to DSTU ISO 5500:2005. This measurement is necessary in order to monitor daily the operation of the press, and also, when testing new makes of presses.

The fat content in the seeds, oilcake, and pores of the crushed material was determined by exhaustive extraction in a Soxhlet extractor.

The acid number was determined according to utility model patent No. 107906 Ukraine MPK G01N 33/03 (2006.01) [23]. The oil obtained before pressing (in the Soxhlet extractor) and after pressing grape seeds of different cultivars by the above methods was placed in a 250 cm^3 conical flask. Three to five grams of the fat analysed was weighed with accuracies down to 0.01 g and melted in a bain-marie, then 50 cm^3 of neutralised alcohol and hexane mixture was poured into the vessel to fill it up, and the sample was stirred. The resulting solution, continuously stirred, was quickly titrated with a potassium or sodium hydroxide (C (KOH) = 0.1 mol/dm^3) solution until it became distinctly pink and could keep the colour for 30 s.

During titration with a potassium or sodium hydroxide solution, the quantity of alcohol in the composition of the alcohol and hexane mixture should be 5 times as big as the volume of the potassium or sodium hydroxide solution, so as to avoid hydrolysis of soap formed. The acid number (AN) expressed in mg KOH/g is calculated according to the formula:

$$AN = \frac{V \cdot k \cdot c(KOH) \cdot M(KOH)_{eq}}{m} \quad (1)$$

where *V* is the volume of the KOH or NaOH solution spent on titration, cm^3;

k is the correction coefficient for the alkali solution to be expressed in terms of exact 0.1 mol/dm^3;

m is the weight of the fat under study, g;

c (KOH) is the molar concentration of an alkali, 0.1 mol/dm^3;

$M (KOH)_{eq}$ is the molar equivalent mass equal to 56.11 g/mol.

The smell, taste, colour, and transparency of oil from different grape seed varieties were determined according to DSTU 8842:2019.

The fatty acid composition of the native seeds and cold-pressed oils was determined by gas–liquid chromatography on a gas chromatograph Hewlett Packard HP-6890 according to DSTU ISO 5508:2001. Oil from native grape seeds was isolated by extracting with hexane and pressing.

The quantitative and qualitative composition of phenolic compounds was determined according to DSTU 4112:2003. Extracts from the samples were prepared by tincturing in 70% ethanol (1 g of the sample per 10 ml of the extractant) for 5 days. Polyphenols were analysed by the BEPX method with the chromatography system Shimadzu (Japan), using a reversed-phase column Microsorb-MV C18 (length 150 mm, diameter 4.6 mm, sorbent grain size 5 μm). The eluents were the system of methanol and a 0.9% phosphoric solution. The gradient mode of chromatography was used, developed for better division of certain phenolic acids and flavonoids in plant extracts.

The substances in the extracts analysed were identified by comparing the retention time and the spectral characteristics of the substances under study with the same characteristics of the standards. The spectral characteristics of the substances and the degree of their similarity to the standards were determined based on the results of scanning the extracts at 225, 255, 286, and 350 nm in accordance with the technique of identifying phenolic compounds. To identify or determine precisely whether the substances studied belonged to certain groups of phenolic compounds, the following external standards were used (Sigma-Aldrich, Germany): chlorogenic and caffeic acids, catechin, the flavonols quercetin, rutin, and myricetin, the flavanones naringenin, naringin, hesperidin, and apigenin.

The identifying characteristics of these standards were obtained under the above-described chromatography conditions. The calibration dependencies between the peak area and the content were linear, with the accuracy not less than r^2=0.994.

The content of the substances identified as belonging to certain flavonoid groups was determined using standards with the maximum similarity, the chemical form of a substance (aglycone, glycoside) being taken into account. The substances with the degree of similarity to any standard less than 70% were classed as unidentified, and their content was determined by the standards they were most similar to.

The total content of polyphenolic compounds was determined by summing up the contents of the substances found within the range of the peaks of flavonoids and phenolic acids in the chromatograms.

All the numerical data obtained were processed with the Excel programme from the service software package Microsoft Office 2007. The numerical data were presented in the form of the arithmetic mean and the standard deviation (M±m).

Results of the research and their discussion

When oil raw materials are delivered to a fat-and-oil enterprise, their quality parameters are tested at the very beginning to determine the quality characteristics of these materials and their economic potential and to arrange the technological process. The raw materials considered in this research were the seeds of the grape cultivars Moldova, Lydia, Cabernet, and the blend (50:50) Muscat Blanc + Noah. Table 1 presents the data on the quality parameters analysed for these seed varieties.

The research results have shown the highest content of the impurities (4.3%) in Muscat Blanc + Noah, so this blend can be labelled as Grade 2, according to DSTU 7546:2014. The Moldova seeds belong to this grade, too. Grade 1 includes the Lydia and Cabernet seeds, based on their characteristics. The findings on the mass fraction of moisture indicate that the blend Muscat Blanc + Noah is the highest in moisture (11.5%), thus it is beyond the limits provided for in DSTU 7546:2014. The other cultivars, by this parameter, belong to the Grade 1 standard (8–10%). By the results of determining the volumetric mass, the highest parameter is that of the Cabernet grape seeds, and this means they are the smallest in size. By the weight of 1000 seeds, the Lydia seeds are the largest. According to DSTU ISO 658:2006, if seeds are large-sized and heavy, this indicates that they are highly nutritious and the germs in them are well-developed. The Cabernet seeds have been found to be 5 mm long, which is far shorter than in the other varieties, whereas the Lydia seeds are the longest of them (7 mm). The oil content is considered one of the main parameters of grape seeds to be processed in the fat-and-oil industry. The highest value of the oil content is in the seeds of the Cabernet variety (20.6%), and the lowest is that of the Moldova seeds (14.7). The acid number indicates that all the grape seed samples comply with the Grade 1 standard (not more than 3.0 mg KOH/g), according to DSTU 7546:2014. The biggest acid number is that of the Moldova seeds (1.90 mg KOH/g), and the smallest is that of the Lydia seeds (1.5 mg KOH/g).

The next step was developing technological conditions of different stages of pressing seeds of the grape varieties cultivated in the Odessa Region.

Crushed mass of seeds was obtained from the grape berries by comminuting them as finely as to achieve the undersize of 90–95% for a screen with 1 mm meshes. In the course of processing, it is practical to apply wet-heat treatment to the crushed seeds before they enter the press: by this, we overcome or weaken noticeably the forces that bind oil with the upper parts of crushed seeds, and facilitate its separation from the oil-free components [5]. Table 2 presents the data on how the degree of filling the pores in crushed seeds with oil depends on the parameters of the wet-heat treatment (its temperature and duration).

Table 1 – Quality parameters of seeds of different grape varieties (n=3; P≥0.95)

Parameter	Lydia	Moldova	Cabernet	Blend Muscat Blanc + Noah (50:50)
Impurities, %	0.69±0.3	1.20±0.4	0.89±0.3	3.97±1.8
Oil admixture, %	0.01±0.01	1.68±0.7	0.09±0.4	0.31±0.1
Total contamination, %	0.70±0.3	2.88±1.6	0.98±0.5	4.28±0.3
Moisture, %	10.20±1.3	10.70±1.2	10.50±1.4	11.50±1.6
Volumetric mass, g	212.60±4.4	181.60±3.6	418.40±8.3	194.30±4.3
Weight of 1000 seeds, g	21.50±2.6	20.40±2.1	10.20±1.3	16.60±2.1
Length of seeds, mm	7.00±0.9	6.50±0.8	5.00±0.6	5.50±0.7
Oil content, %	20.20±2.4	14.70±1.9	20.60±2.4	18.50±2.3
Acid number, mg KOH/g	1.50±0.6	1.90±1.2	1.60±0.7	1.60±0.8

Table 2 – Wet-heat treatment of the crushed seeds from different grape varieties (n=3; P≥0.95)

Parameter	Lydia			Moldova			Cabernet			Blend Muscat Blanc + Noah (50:50)		
	Stages											
	I	II	III	I	II	III	I	II	III	I	II	III
Temperature, °C	30.0 ±4.3	40.0 ±5.3	50.0 ±7.5	30.0 ±4.3	40.0 ±5.3	50.0 ±7.1	30.0 ±2.3	40.0 ±6.3	50.0 ±6.3	30.0 ±3.3	40.0 ±7.3	50.0 ±8.3
Time, min	15.0 ±1.3	20.0 ±2.3	25.0 ±3.6	5.0 ±0.3	10.0 ±1.4	15.0 ±1.0	5.0 ±0.1	10.0 ±1.6	15.0 ±0.9	15.0 ±1.7	20.0 ±4.3	25.0 ±4.3
Degree of filling the pores in crushed seeds with oil, %	90.0 ±7.3	100.0 ±9.1	80.0 ±6.3	90.0 ±6.8	100.0 ±9.9	80.0 ±5.2	90.0 ±7.3	100.0 ±10.3	80.0 ±4.3	90.0 ±3.3	100.0 ±8.9	80.0 ±4.3

From Table 2, one can see that moisturising is the most effective at the first and second stage, as compared with the third one. The crushed seeds of the Cabernet and Moldova grapes have the treatment temperature 30–40°C for 5–10 min. The crushed Lydia and Muscat Blanc + Noah seeds are exposed to the treatment temperature 30–40°C for 15–20 min. Also, in all the grape seed varieties, the pores in the crushed seeds open up completely and are filled with oil: by 90% at the first stage, and by 100% at the second stage. All this creates favourable conditions for the further stage.

The mash obtained is sent to pressing. It was carried out in steps, with certain pressure maintained and duration observed. Table 3 shows how the conditions of pressing depend on the loading speed, the compressive force, and the load action time.

The thickness of an oilcake piece is a major indicator of the operation of a press and the yield of oil. Determining this parameter allows monitoring daily the operation of a press, and is necessary when testing new makes of presses.

Table 3 makes it clear that the thickness of an oilcake piece determines the effectiveness of pressing. The thinner a piece, the more effectively it is pressed: the load action time, compressive force, and loading speed decrease significantly, while the output of oil increases. So, for all grape seed varieties, the first stage of pressing is the most effective: with the residual oil content in the cake 5.0–6.0%, the output of oil is 94.0%, the thickness of oilcake is 33.0 mm, the load action time is 3.0 min, the compressive force is 10.0 kN, and the loading speed is 5.0 kN/cm.

Oil pressed out of different grape seed varieties contains a lot of suspended particles, in particular, those of minerals. Oil is cleared of mechanical impurities by their sedimentation. Then it can be stored or used for further purposes.

Oilcake is good as food and animal feed, and can be used to manufacture activated carbon, cosmetic products, or as fertiliser.

Fig. 1 shows a flow chart of the suggested technology of producing oil from different grape seed varieties, with the experimentally confirmed process conditions that have been described above.

Sensory studies of oil from different grape seed varieties have been carried out. Their results are presented in Fig. 2. The taste and smell of oils from different grape seed varieties depend on the type and quality of the raw materials processed (oil obtained from defective seeds can smell and taste unpleasant and stale), on the production method (pressing or solvent extraction), and the equipment's operational modes. The colour of vegetable oils is determined by colourants (pigments) in their composition, such as carotenoids and chlorophyll. Transparency is the parameter showing that the vegetable oil (at 20°C) is free from turbidity or suspended matter seen with the naked eye and degrading the product's appearance and quality.

In the profilogram, one can see that oil from the Cabernet seeds, by a complex of parameters, is rated the highest (4.9), the oil from the blend Muscat Blanc + Noah comes second (its average score being 4.8), and the Moldova and Lydia oils have received 4.76 and 4.75 respectively.

According to the data from literature, different grape seed varieties have unique chemical compositions, are high in polyunsaturated linoleic acid of the ω-6 class, monounsaturated oleic acid of the ω-9 class (15% to 25%), and smaller quantities of saturated palmitoleic acid and other saturated acids [9].

This made it necessary to determine the fatty acid composition (FAC) in the oil samples from different grape seed varieties. The fatty acid compositions of the oils under study before pressing (in the raw materials prior to heat treatment) and after pressing are given in Table 4.

Table 3 – Conditions of pressing (n=3; P≥0.95)

Processes	**Lydia**			**Moldova**			**Cabernet**			**Blend Muscat Blanc + Noah (50:50)**		
	Stages of pressing											
	I	II	III	I	II	III	I	II	III	I	II	III
Loading speed, kN/cm	5.0 ±1.3	10.0 ±4.3	15.0 ±7.3	3.0 ±2.3	6.0 ±2.3	12.0 ±6.3	1.25 ±0.3	3.0 ±1.3	6.0 ±4.3	0.25 ±0.4	1.25 ±0.9	1.95 ±1.3
Compressive force, kN	10.0 ±2.3	13.0 ±6.3	14.0 ±7.5	20.0 ±6.8	25.0 ±5.1	30.0 ±7.2	50.0 ±8.3	55.0 ±9.3	60.0 ±4.3	90.0 ±7.6	95.0 ±8.4	99.0 ±7.8
Load action time, min	3.0 ±0.3	6.0 ±5.3	8.0 ±6.3	5.0 ±4.3	10.0 ±4.8	15.0 ±3.3	10.0 ±4.3	15.0 ±4.3	18.0 ±7.1	5.0 ±0.7	10.0 ±7.6	15.0 ±6.4
Thickness of the oilcake, mm	33.0 ±3.3	35.0 ±4.3	38.0 ±5.6	33.0 ±7.2	34.0 ±6.4	39.0 ±7.3	33.0 ±4.3	36.0 ±2.3	41.0 ±3.8	33.0 ±4.7	34.0 ±5.6	37.0 ±6.4
Yield of oil, %	94.0 ±9.3	92.0 ±8.6	89.0 ±7.4	94.0 ±9.1	93.0 ±6.3	88.0 ±8.5	94.0 ±9.7	91.0 ±7.3	86.0 ±4.8	94.0 ±4.3	93.0 ±8.6	90.0 ±9.3

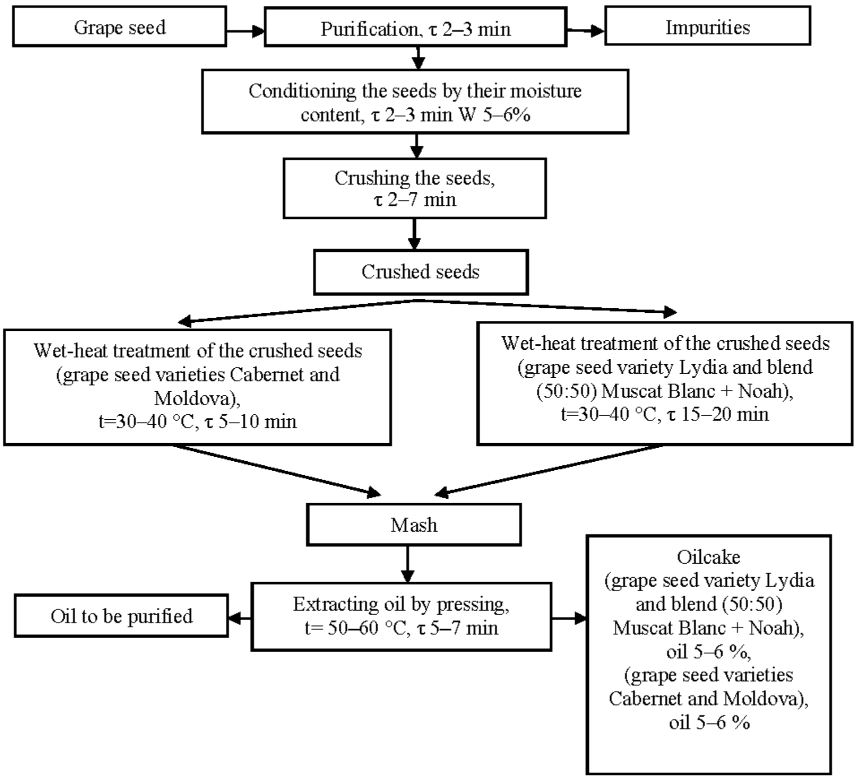

Fig. 1. Flow chart of the technology of producing oil from different grape seed varieties

Fig. 2. Profilogram of the sensory characteristics of oil from different grape seed varieties

Table 4 – Fatty acid composition of oil from different grape seed varieties before pressing (in the raw materials prior to heat treatment) and after pressing (n=3; P≥0.95)

Oil from different grape seed varieties	Before pressing		After pressing	
	Fatty acid content in oil , %			
	ω-6 PUFA	ω-9 MUFA	ω-6 PUFA	ω-9 MUFA
Lydia	70.1±1.3	18.4±0.3	69.8±3.8	17.7±0.3
Moldova	72.7±3.3	16.9±0.9	72.4±4.3	16.6±0.7
Cabernet	79.5±3.9	12.6±0.7	78.4±4.0	11.8±0.9
Blend (50:50) Muscat Blanc + Noah	68.9±2.3	20.5±1.3	67.9±2.8	19.9±1.7

The analysis of the fatty acid composition of the oils have resulted in data confirming that with applying the suggested technology Extra Virgin, the FAC is retained. In the Lydia oil, it makes up to 99.5% of ω-6 PUFA and 96.2% of ω-9 MUFA, in the Moldova oil, up to 99.6% (ω-6 PUFA) and 98.2% (ω-9 MUFA), in the Cabernet oils, up to 98.6% (ω-6 PUFA) and 93.7% (ω-9 MUFA), and in the oils from the blend Muscat Blanc + Noah, up to 98.5% (ω-6 PUFA) and 97.1% (ω-9 MUFA).

There is also a method of processing different grape seed varieties into polyphenol extracts without pre-extracting oil from them. Of scientific and practical interest are the studies to determine the priority in obtaining oils and polyphenol extracts from seeds of different grape cultivars grown in the Odessa Region [10].

The experimental data have shown that obtaining oil from different grape seeds should precede the extraction of polyphenolic compounds: it allows producing extracts with the concentration of phenolic compounds by 80–120% higher than that of extracts from different grape seeds without preliminary extraction of oil (Table 5).

Table 5 – Concentration of phenolic compounds in extracts from different grape seed varieties before extracting grapeseed oil (in the raw materials prior to heat treatment) and after it (n=3; P≥0.95)

Grape seed variety	Mass concentration of phenolic compounds, mg/dm^3
Before pressing	
Lydia	4157.0±13.3
Moldova	6443.4±37.4
Cabernet	3117.8±11.1
Blend (50:50) Muscat Blanc+ Noah	4988.4±18.3
After pressing	
Lydia	10392.5±67.3
Moldova	17459.4±53.2
Cabernet	7482.6±23.3
Blend (50:50) Muscat Blanc + Noah	13718.1±17.9

As can be seen from Table 5, the increased content of phenolic compounds in the extracts from different grape seed varieties with oil pre-extracted may be due to the higher level of destruction of a seed's cellular membrane or to the destruction of intermolecular bonds preventing the maximum extraction of phenolic compounds.

Field testing of the results.

Based on this research, the grapeseed oil technology developed has been introduced into the production process at Odessa Factory of Kernel and Vegetable Oils TOV AVA.

Conclusion

Seeds of Odessa Region-grown grape varieties Lydia, Moldova, Cabernet, and the blend Muscat Blanc + Noah (50:50) have been studied as promising raw materials for fat-and-oil products and cosmetics.

A technology have been developed to obtain oils from a number of varieties of the region's grape seeds, namely, appropriate process conditions have been selected to obtain extra virgin oil by cold pressing. Wet-heat treatment of crushed Cabernet and Moldova seeds was carried out at the temperature 30–40°C for 5–10 min. For the crushed seeds of Lydia and the blend Muscat Blanc + Noah (50:50), the temperature of treatment was 30–40°C, and the duration 15–20 min. When extracting oil by pressing, heating the treated crushed seeds (extraction mash) to over 50–60°C for more than 5–7 min must be avoided.

It has been established that the oil content in the seeds of the Lydia, Moldova, and Cabernet grapes, and of the blend Muscat Blanc + Noah (50:50) is 14–20%.

The suggested process conditions of producing oils allow the maximum retention of the initial fatty acid and phenolic composition of raw materials.

It has been found out that the fatty acid and phenolic composition of the fat-and-oil products is retained. Oil from seeds of different grape cultivars grown in the region contains a favourable fatty acid complex. Oil from the Lydia variety contains up to 99.5% of ω-6 PUFA and 96.2% of ω-9 MUFA, from the Moldova variety up to 99.6% of ω-6 PUFA and 98.2% of ω-9 MUFA, from the Caberne variety up to 98.6% of ω-6 PUFA and 93.7% of ω-9 MUFA, and from the blend Muscat Blanc + Noah (50:50) up to 98.5% of ω-6 PUFA and 97.1% of ω-9 MUFA. The difference in the values depends on the grape seed variety and on the method of obtaining oil from it. The experimental data have shown that obtaining oil from different grape seeds should precede the extraction of polyphenolic compounds: it allows producing extracts with the concentration of phenolic compounds by 80–120% higher than that of extracts from native (untreated) seeds of different grape cultivars.

The sensory assessment has shown positive results for oils from seeds of different grape varieties. By the complex of parameters, the average score of the Cabernet cultivar was the highest (4.9), the second best was the oil from the blend Muscat Blanc + Noah, with the average rating 4.8, and the oils from the Moldova and Lydia seeds received 4.76 and 4.75 respectively.

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РОЗРОБЛЕННЯ ТЕХНОЛОГІЇ ОЛІЇ З НАСІННЯ ВИНОГРАДУ ОДЕСЬКОГО РЕГІОНУ ЗІ ЗБЕРЕЖЕННЯМ ЯКІСНИХ ХАРАКТЕРИСТИК

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Анотація. Досліджено можливість використання насіння винограду Одеського регіону сортів Лідія, Молдова, Каберне та суміші Мускат білий+Ноа (50:50) як перспективної сировини для отримання олійно-жирової та косметичної продукції. У роботі обгрунтовано технологію олій з різних сортів виноградного насіння Одещини. Підібрано технологічні режими холодного пресування Extra Virgin для насіння різних сортів винограду. Волого-теплове оброблення м'ятки із насіння сортів Каберне і Молдова доцільно проводити за температури 30–40°С протягом 5–10 хвилин, а із насіння сортів Лідія та суміші Мускат білий+Ноа (50:50) – за тієї ж температури протягом 15–20 хвилин. При вилучені олії пресуванням рекомендується не допускати нагрівання мезги вище 50–60°С протягом 5–7 хвилин. За результатами досліджень встановлено, що вміст олії у насінні винограду сортів Лідія, Молдова, Каберне та суміш Мускат білий+Ноа (50:50) складає 14–20%. Отримання олій за запропонованими технологічними режимами дозволяє максимально зберегти вихідний жирнокислотний і фенольний склад сировини. Доведено, що у складі олії, отриманої із насіння винограду сорту Лідія, вміст ω-6 жирних кислот складає 99,5%, вміст ω-9 – 96,2% від їхнього вихідного вмісту у складі сировини. У складі олії, отриманої із насіння сорту Молдова, вміст ω-6 складає 99,6%, ω-9 – 98,2% від вихідного; із сорту Каберне – вміст ω-6 складає 98,6%, ω-9 – 93,7% від вихідного; із суміші Мускат білий+Ноа (50:50) – вміст ω-6 складає 98, 5%, ω-9 – 97, 1% від вихідного. Доведено, що вилучення олії з насіння різних сортів винограду має передувати екстрагуванню фенольних сполук. Концентрація фенольних речовин в екстрактах, отриманих із сировини, із якої попередньо вилучили олію за пропонованими режимами, на 80–120% більша, у порівнянні з екстрактами, отриманими з нативного насіння різних сортів винограду.

Ключові слова: виноградне насіння, технологія пресування, extra virgin, м’ятка, олія з виноградного насіння, макуха з виноградного насіння, жирнокислотний склад.