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DEVELOPING A TECHNOLOGY OF OBTAINING EXTRA VIRGIN OILS FROM KERNELS OF STONES OF VARIOUS APRICOT CULTIVARS GROWN IN THE ODESA REGION

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Introduction. Formulation of the problem

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

The currently used technology of extracting useful components from kernels of apricot stones is based on pretreating them and pressing them on worm presses. This technology involves the following operations: cracking the stones quickly, isolating their kernels, purifying and separating them from admixtures, and drying them till the residual moisture content is 12–14%.

Higher yields of oil from apricot kernels greatly depend on the thoroughness of crushing and the degree of destruction of the cellular structure. The

Abstract. It has been studied whether the kernels (endocarps) of stones obtained from apricots grown in the Odesa region (the cultivars Shablovsky, Kyivsky Ananasny, Ananasny Tsiurupynsky, and Krasnoshchoky) are prospective raw materials for fat-and-oil and beauty products. The study provides a basis for a technology of producing oils from the kernels of stones of various apricot cultivars harvested in the region. The most suitable cold pressing modes (extra virgin) have been chosen for kernels obtained from different cultivars. Crushed apricot kernels should be wet-treated and heat-treated at 40–50°C for 15–20 min. During extraction by pressing, it is recommended that the crushed kernels (mash) should not be heated above 50–60°C for 5–7 min. The effectiveness of pressing has been established: the kernels of stones of the cultivars Shablovsky, Kyivsky Ananasny, Ananasny Tsiurupynsky, and Krasnoshchoky contained 33–37% of oil. The thickness of an oilcake piece determines the effectiveness of pressing extraction. The thinner the oilcake piece, the more effective the pressing is: the load withstanding time, the pressing force, and the loading rate are significantly reduced, and the produce of oil increases. Thus, the pressing extraction stage most effective for the kernels of all the apricot cultivars is as follows: residual oil content in the oilcake 5.0–6.0%, oil yield 94.0%, oilcake thickness 33.0 mm, load withstanding time 3.0 min, pressing force 10.0 kN, loading rate 5.0 kN/cm.

The proposed technological mode of producing oils allows retaining, to a maximum extent, the original fatty acid composition of the raw material. It has been proved that oil from the kernels of apricot stones of the Shablovsky variety contains up to 96.4% of ω -6 PUFA and 95.7% of ω 9 MUFA. In the cultivar Kyivsky Ananasny, these parameters are up to 97.7% and 98.3% respectively, and in Ananasny Tsiurupynsky, they are up to 96.4% and 93.9% respectively. The Krasnoshchoky cultivar is up to 99.0% high in ω -6 PUFA and up to 98.4% high in ω 9 MUFA, compared with the original level.

Key words: kernels of apricot stones; pressing extraction technology; extra virgin; crushed kernels (mash); oil from kernels of apricot stones; oilcake from kernels of apricot stones; fatty acid composition.

hardness of the outer covering of apricot stones is the main obstacle to efficient oil extraction. This research topic is of current importance, because efficient utilisation of apricot processing by-products is a highly topical problem that needs further study [2].

Apricot stones make up to 45% of the volume of a fruit processed into sweet whole-fruit preserves, jams, confitures, and purées. They are separated from the rest of the material, dried, and crushed in order to destroy the hard coating. It is recommended to pretreat them in order to facilitate the cracking process. These stages are 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 apricot kernel 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 kernels of stones of different apricot varieties, establishing their regional specific features, and developing new technologies of obtaining fat-and-oil products from stones of various apricot cultivars.

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 processing the kernels (endocarps) of apricot stones [4].

A valuable and highly promising source is the kernels of stones of different apricot cultivars containing beneficial nutritious and biologically positive substances. Processing apricot fruit into juice and kuraga (dried apricots) leaves a byproduct, apricot stones rich in valuable oil and bioactive substances [5,6].

It has been studied how to convert kernels of apricot stones into fat-and-oil products and how to apply this technology [7,8].

There are three methods of producing oil from kernels of apricot stones:

- 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, kernels 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 oil from apricot stones. Higher-quality oil for food purposes is obtained from processing kernels of apricot stones isolated from their hard covering (hull) at canneries *in situ*. To this end, stones are immediately washed to get rid of extractives, dried till the moisture content is 12–14%, crushed roughly to separate the dry covering of fruit, and then the released stones are separated [9-13].

The classical method of obtaining oil from apricot kernels is press extraction [14-16]. The technology of processing apricot stones by pressing includes the following operations: removing alien weeds from the stones, conditioning the stones (drying to the moisture level not more than 11%), if necessary, cracking the stones in order to obtain fragmented mass, sorting the mass into kernels and their outer shells, crushing the kernels with the use of ribbed or smooth rolls, preparation of mash in a heating vat, and compressing the mash on expellers providing single-time residual

pressing. When kernels of apricot stones are pressed, the efficiency of the oil yield is determined by how finely they are comminuted and how deep the cellular structure is cleaved. Apricot stones are characterised by a specific structure: their outer covering is thick, strong, and hard-structured. That is why when crushed kernels are prepared for pressing, their high moisturising is recommended (up to 16%) [17].

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 processing kernels of apricot stones. The existent manufacturing schemes are based on extracting oils by means of such hydrocarbon solvents as petroleum ether, hexane, or other solvents with similar boiling points [18].

A kernel is mostly consumed unprocessed, as an important source of dietetic protein, oil, and fibre. It is a cheap substitute for almonds in baked goods, dried fruit, and confectionery. Besides, kernels are used when manufacturing oil, benzaldehyde, cosmetics, activated carbon, and perfume [19].

A tradition of recent years is the use of the coating left on isolating the kernels as fuel and as a component of medium-density fibreboard. In recent years, there has been a greatest-ever demand for oil from apricot kernels due to its medicinal properties. Along with being used by local people, it attracts a lot of tourists who visit the region and find apricot oil a good present as a personal care product [19]. 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.

There is a traditional oil extraction method still used in India. Analysis of the kernels of apricot stones from the Indian region showed that they were a rich source of oil (up to 54.21%), protein (17.75–22.56%), carbohydrates (21.16–35.26%), crude fibre (0.84–4.71%), and dietary fibre (6.03–22.24%). Apricot kernel oil is also rich in unsaturated fatty acids (94.4%), oleic acid (66.2%), and linoleic acid (28.2%) [19].

A byproduct of processing apricot kernels, oilcake, has various applications. It is fed to animals and used as a nutritional supplement [19].

Oil from kernels of apricot stones is high in mono and polyunsaturated fatty acids, tocopherols, phospholipids, salts of potassium and magnesium. Since it contains not more than 1% of rapidly oxidising ω -3 linolenic acid, this oil is quite storable [20].

Foreign researchers point out various pharmacological effects of the apricot and the kernel of its stone. These include antiparasitic, anticarcinogenic, anti-ageing, anti-atherosclerotic, anti-anginal, cardioprotective, hepatoprotective, renoprotective, and (especially β -carotene) antioxidant properties. Apricot fruit are rich in valuable minerals, especially K, Fe, Mg, and P. The apricot is an excellent source of vitamins A, C, and E and of fibre. It has sedating, antispasmodic,

anticestodal, antimicrobial, antimutagenic, antitussive, anti-inflammatory, and tonic effects [21]. The apricot's main components are flavonoids, such as quercetin-3-rutinoside, quercetin-3-galactoside, and quercetin-3-glucoside [22,23]. Also, apricot kernel oil was reported to be a better improver of the antioxidant condition of rats' liver, as compared with sunflower oil [22].

Secondary byproducts and waste produced in the agro-industrial complex and food industry are still not fully utilised.

Thus, the technology of obtaining oil from kernels of stones of different apricot varieties needs further development.

The **purpose** of the research is to develop a technology of obtaining extra virgin oils from kernels of stones of different Odesa Region-grown apricot varieties, with their quality characteristics retained, by developing new process conditions and regulating the duration of pressing.

The **objectives** of the research:

1. To study the quality parameters of the kernels of stones of different apricot varieties.
2. To develop a technology of obtaining extra virgin oil from the kernels of stones of different apricot varieties grown in the Odesa Region.
3. To study the fatty acid composition of these oils.

Research materials and methods

The following cultivars characteristic of the Odesa Region were selected as the source of the kernels of apricot stones that became the raw materials for oil: Shablovsky, Kyivsky Ananasny, Ananasny Tsiurupynsky, and Krasnoshchoky, all 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 the kernels and the hard covering of apricot stones 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 apricot stones was determined according to DSTU ISO 658:2006.

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

The weight of 1000 stones 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 kernels of apricot stones 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 apricot oilcake piece 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 apricot kernels, oilcake, and pores of the crushed material was determined by exhaustive extraction in a Soxhlet extractor according to DSTU ISO 7577:2014.

The acid number was determined according to utility model patent No. 107906 Ukraine MPK G01N 33/03 (2006.01) [24]. The oil obtained before pressing (in the Soxhlet extractor) and after pressing the kernels of stones of different apricot cultivars by the above methods was placed in a 250 cm³ conical flask. Three to five grams of the fat analysed was weighed with accuracies down to 0.01 g and heated in a bain-marie, then 50 cm³ of neutralised alcohol/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/dm³) 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/hexane mixture should be 5 times as big as the volume of the potassium or sodium hydroxide solution, so as to avoid hydrolysis of the soap formed. The acid number (AN) expressed in mg KOH/g was 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, cm³;

k is the correction coefficient for the alkali solution to be expressed in terms of exact 0.1 mol/dm³;

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

$c(KOH)$ is the molar concentration of an alkali, 0.1 mol/dm³;

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

The smell, taste, colour, and transparency of oil from the kernels of stones of different apricot varieties were determined according to DSTU 8842:2019.

The fatty acid composition of the apricot kernels and oils cold-pressed from them was determined by gas-liquid chromatography on a gas chromatograph Hewlett Packard HP-6890 according to DSTU ISO 5508:2001 [25].

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

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. Table 1 presents the data on the quality parameters analysed for the kernels

from these apricot varieties.

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

Parameter	Shablovsky	Kyivsky Ananasny	Ananasny Tsiurupynsky	Krasnoshchoky
Impurities, %	2.37±0.3	2.03±0.4	2.55±0.3	2.97±1.8
Oil admixture, %	0.1±0.01	0.5±0.7	0.9±0.4	0.31±0.1
Total contamination, %	2.47±0.3	2.53±1.6	3.25±0.5	3.28±0.3
Moisture, %	8.10±1.3	7.60±1.2	9.30±1.4	8.40±1.6
Volumetric mass, kg	2.500±4.4	1.700±3.6	1.800±8.3	1.800±4.3
Weight of 1000 stones, kg	2.150±2.6	1.550±3.6	1.600±8.3	1.580±4.3
Length of a stone, mm	22.00±0.9	20.50±0.8	23.00±0.6	20.00±0.7
Oil content, %	37.20±2.4	34.40±1.9	35.50±2.4	33.80±2.3
Acid number, mg KOH/g	1.60±0.6	0.95±1.2	1.70±0.7	0.50±0.8

The research results have shown the highest content of the impurities (2.97%) in the Krasnoshchoky stones, so this cultivar can be labelled as Grade 2, according to DSTU 30306:95. The Ananasny Tsiurupynsky stones belong to this grade, too. Grade 1 includes the Shablovsky and Kyivsky Ananasny stones, based on their characteristics. The findings on the mass fraction of moisture indicate that all the cultivars, by this parameter, belong to the Grade 1 standard (8–10%) and comply with DSTU 30306:95. By the results of determining the volumetric mass, this parameter is the highest in the Shablovsky stones, and this means they are the largest in size. By the weight of 1000 stones, the Shablovsky stones are the heaviest. According to DSTU ISO 658:2006, if a stone is large-sized and heavy, this indicates that it is highly nutritious and the germ in it is well-developed. The Krasnoshchoky stones have been found to be 20 mm long, which is shorter than in the other varieties, whereas the Ananasny Tsiurupynsky stones are the longest of the four (23 mm). The oil content is considered one of the main parameters of kernels of apricot stones to be processed in the fat-and-oil industry. The highest value of the oil content is in the kernel of the Shablovsky variety (37.2%), and the lowest is that of the Krasnoshchoky kernel (33.8%). The acid number indicates that all the kernel 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 Ananasny Tsiurupynsky kernel (1.70 mg KOH/g), and the smallest is that of the Krasnoshchoky kernel (0.50 mg KOH/g).

The next step was developing technological conditions of different stages of pressing the kernels of stones of the apricot varieties cultivated in the Odesa Region.

The hull of fruit stones is quite hard and strong. To crack it more easily, the aqueous salt solution (3:1) was used, which resulted in the softening of the hull and its easier separation. The softened stones were then sent to be cracked.

While cracking stones, the kernels are separated from the outer covering. The efficiency of cracking is determined by the physical properties of the stones and their mechanical strength. A kernel high in moisture is very tightly pressed against the hull walls, that is why cracking a stone with increased moisture, firstly, leads

to the unwanted crushing of the kernel itself and the formation of a lot of choppings, and, secondly, takes much effort to destroy the hull.

When a stone is dried till its moisture content is 11–12%, its kernel reduces in size. This results in an air-filled space formed between the kernel and its covering. When cracking stones, this space allows adjusting the crushing rolls, so that destruction of the hull leaves the kernel undamaged, pressed upon but slightly. Virtually in each case, the width of the space between the rolls must not exceed the thickness of a cracked stone: with a space of about 80% of a stone's thickness, the hull only deforms but is not destroyed.

Crushed mass of kernels was obtained from the apricot stones 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 the stones, it is practical to apply wet-heat treatment to the crushed kernels before they enter the press: by this, we overcome or weaken noticeably the forces that bind oil with the upper parts of the crushed kernels, 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 kernels with oil depends on the parameters of the wet-heat treatment (its temperature and duration).

From Table 2, one can see that moisturising is the most effective at the second and third stages, as compared with the third ones. The crushed kernels of the stones of all the four cultivars have the treatment temperature 40–50°C for 5–10 min. At these temperatures, the pores in the crushed kernels are completely filled with oil: by 90% at the second stage, and by 100% at the third stage. All this creates favourable conditions for the further stage of processing.

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 (loading speed, compressive force, load withstanding time) determine its efficiency.

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 2 – Dependence of the oil level in the pores in crushed kernels upon the parameters of the wet-heat treatment (n=3; P≥0.95)

Parameter	Shablovsky			Kyivsky Ananasny			Ananasny Tsiurupynsky			Krasnoshchoky		
	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	10.0 ±3.6	15.0 ±1.3	20.0 ±2.3	10.0 ±0.3	15.0 ±1.4	20.0 ±1.0	10.0 ±0.1	15.0 ±1.6	20.0 ±0.9	10.0 ±1.7	15.0 ±4.3	20.0 ±4.3
Degree of filling the pores in crushed kernels with oil, %	80.0 ±6.3	90.0 ±7.3	100.0 ±9.1	80.0 ±5.2	90.0 ±6.8	100.0 ±9.9	80.0 ±4.3	90.0 ±7.3	100.0 ±10.3	80.0 ±4.3	90.0 ±3.3	100.0 ±8.9

Table 3 – Efficiency of pressing depending on the conditions of the process (n=3; P≥0.95)

Processes	Shablovsky			Kyivsky Ananasny			Ananasny Tsiurupynsky			Krasnoshchoky		
	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	5.0 ±2.3	10.0 ±2.3	15.0 ±6.3	5.0 ±0.3	10.0 ±1.3	15.0 ±4.3	5.0 ±0.4	10.0 ±0.9	15.0 ±1.3
Compressive force, kN	10.0 ±2.3	15.0 ±6.3	20.0 ±7.5	10.0 ±6.8	15.0 ±5.1	20.0 ±7.2	10.0 ±8.3	15.0 ±9.3	20.0 ±4.3	10.0 ±7.6	15.0 ±8.4	20.0 ±7.8
Load withstanding time, min	3.0 ±0.3	6.0 ±5.3	8.0 ±6.3	3.0 ±4.3	6.0 ±4.8	8.0 ±3.3	3.0 ±4.3	6.0 ±4.3	8.0 ±7.1	3.0 ±0.7	6.0 ±7.6	8.0 ±6.4
Thickness of the oilcake piece, 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

Table 3 makes it clear that the thickness of an oilcake piece determines the efficiency of pressing. The thinner the piece, the more efficiently it is pressed: the load withstanding time, compressive force, and loading speed decrease significantly, while the yield of oil increases. So, for all varieties of apricot kernels, the first stage of pressing is the most efficient: 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 withstanding 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 kernels of the stones of different apricot varieties contains a lot of suspended particles, in particular, those of minerals. It 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 proposed technology of producing oil from kernels of the stones of different apricot varieties, with the experimentally confirmed process conditions described above.

Sensory studies of oil from different varieties of apricot kernels have been carried out. Their results are presented in Fig. 2. The taste and smell of oils from kernels of stones of different apricot cultivars depend on the type and quality of the raw materials processed (oil obtained from defective kernels can taste unpleasant and smell 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.

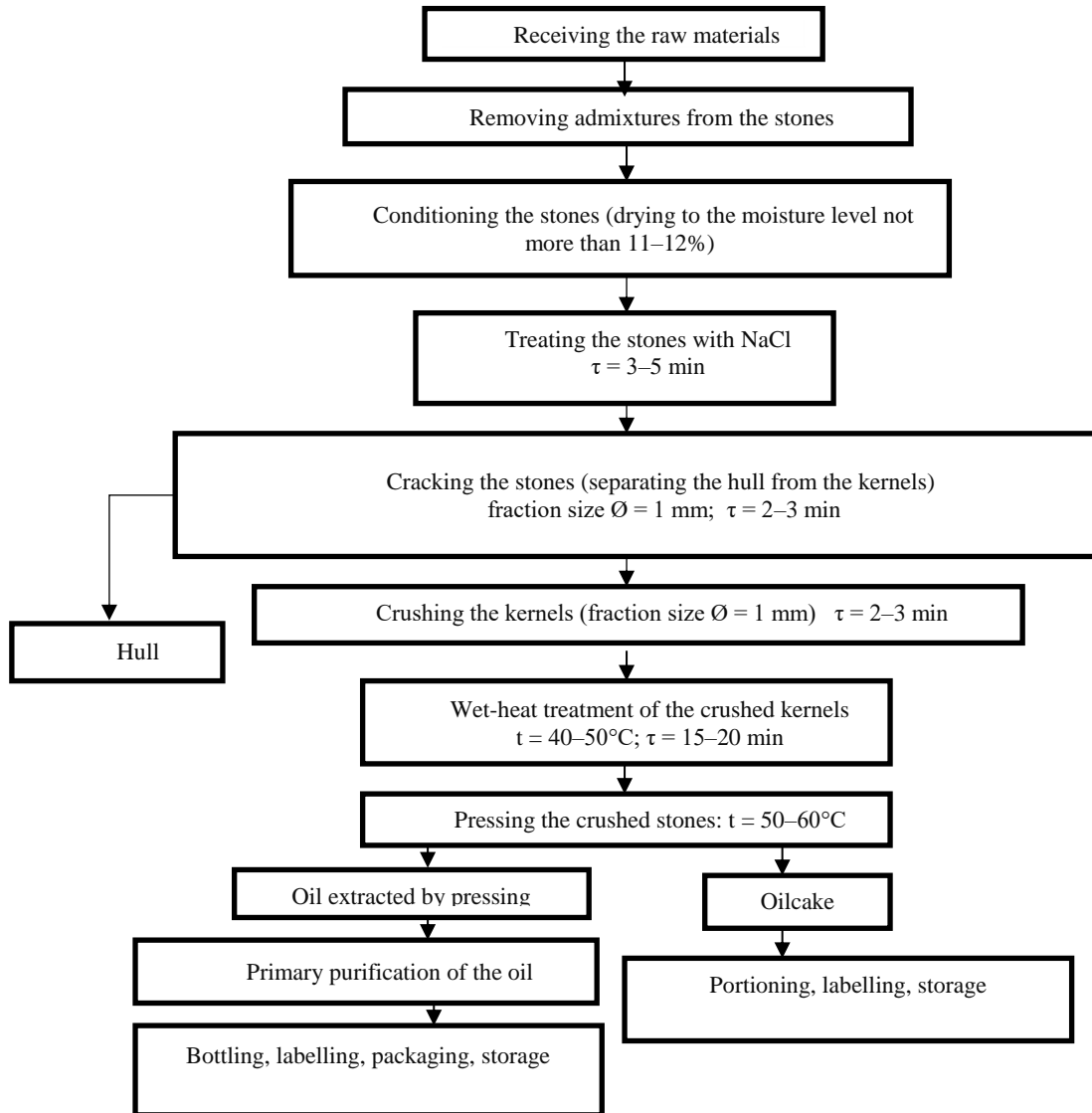


Fig. 1. Flow chart of the technology of producing oil from the kernels of stones of different apricot varieties

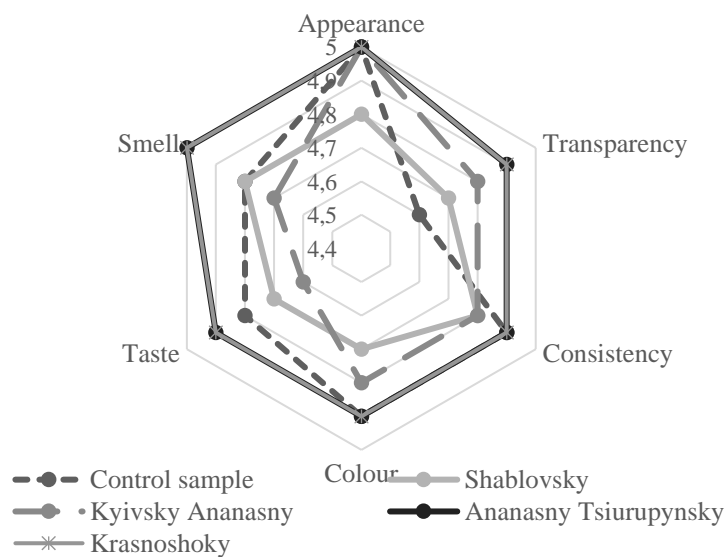


Fig. 2. Profiling of the sensory characteristics of oil from different varieties of apricot kernels

In the profilogram, one can see that the oil from the Shablovsky kernels, by a complex of parameters, is rated the highest (4.9), the oil from the Krasnoshchoky kernels comes second (its average score being 4.8), and the Kyivsky Ananasny and Ananasny Tsiurupynsky oils have received 4.76 and 4.75 respectively.

According to the data from literature, different varieties of apricot stones have unique chemical compositions, are high in polyunsaturated linoleic acid of the ω -6 class (50% to 80%) and monounsaturated oleic acid of the ω -9 class (15% to 25%), and contain 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 varieties of apricot kernels. 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 4 – Fatty acid composition of oil from different apricot kernel varieties before pressing (in the raw materials prior to heat treatment) and after pressing (n=3; P \geq 0.95)

№	Oil from different grape seed varieties	Before pressing		After pressing	
		Fatty acid content in oil, %			
		ω -6 PUF A	ω -9 MUF A	ω -6 PUF A	ω -9 MUF A
1	Shablovsky	36.6 \pm 1.3	63.4 \pm 0.3	35.3 \pm 3.8	60.7 \pm 0.3
2	Kyivsky Ananasny	48.3 \pm 3.3	51.7 \pm 0.9	47.2 \pm 4.3	50.8 \pm 0.7
3	Ananasny Tsiurupynsky	44.7 \pm 3.9	55.3 \pm 0.7	43.1 \pm 4.0	51.9 \pm 0.9
4	Krasnoshchoky	30.3 \pm 2.3	69.7 \pm 1.3	30.0 \pm 2.8	68.6 \pm 1.7

The analysis of the fatty acid composition of the oils have resulted in the data confirming that with applying the proposed technology Extra Virgin, the FAC is retained. The Shablovsky oil contains up to 96.4% of ω -6 PUFA and 95.7% of ω -9 MUFA, the Kyivsky Ananasny oil, respectively, up to 97.7% and 98.3%, the Ananasny Tsiurupynsky oil, respectively, up to 96.4% and 93.9%, and the oil from the Krasnoshchoky cultivar up to 99.0% of ω -6 PUFA and 98.4% of ω -9 MUFA.

Field testing of the results.

Based on the findings of this research, the apricot kernel oil technology developed has been introduced

into the production process at Odesa Factory of Kernel and Vegetable Oils TOV AVA and recommended for manufacturing craft vegetable oils.

Conclusion

Stones of the apricot cultivars Shablovsky, Kyivsky Ananasny, Ananasny Tsiurupynsky, and Krasnoshchoky have been studied as promising raw materials for fat-and-oil products and cosmetics.

A technology have been developed to obtain oil from the kernels of apricot stones of a number of varieties cultivated in the Odesa region. Namely, appropriate process conditions have been selected to obtain extra virgin oil by cold pressing. It has been found most practical to carry out the wet-heat treatment of crushed apricot kernels for 15–20 min at 40–50°C. The efficiency of pressing extraction has been established: the oil content in the kernels of the apricot cultivars Shablovsky, Kyivsky Ananasny, Ananasny Tsiurupynsky, and Krasnoshchoky is 33–37%. The thickness of the oilcake determines the efficiency of pressing. The thinner the oilcake piece, the more efficiently it is pressed: the load withstanding time, compressive force, and loading speed decrease significantly, while the yield of oil increases. So, the most efficient pressing stage has been established for all varieties of kernels of apricot stones: with the residual oil content in the cake 5.0–6.0%, the yield of oil 94.0%, the thickness of the oilcake 33.0 mm, the load withstanding time 3.0 min, the compressive force 10.0 kN, and the loading speed 5.0 kN/cm. When extracting oil by pressing, heating the crushed stones (extraction mash) to over 50–60°C for more than 5–7 min must be avoided. It has been established that the kernels of stones of the cultivars Shablovsky, Kyivsky Ananasny, Ananasny Tsiurupynsky, and Krasnoshchoky contain 33–37% of oil.

It has been found out that the fatty acid composition of the fat-and-oil products is retained. Oil from kernels of different apricot cultivars grown in the region contains a favourable fatty acid complex. Oil from Shablovsky contains up to 96.4% of ω -6 PUFA and 95.7% of ω -9 MUFA, that from Kyivsky Ananasny up to 97.7% of ω -6 PUFA and 98.3% of ω -9 MUFA, that from Ananasny Tsiurupynsky up to 96.4% of ω -6 PUFA and 93.9% of ω -9 MUFA, and that from Krasnoshchoky up to 99.0% of ω -6 PUFA and 98.4% of ω -9 MUFA.

The sensory assessment has shown that, by the complex of parameters, the average score of the oil from Shablovsky kernels was the highest (4.9), the second best was the oil from Krasnoshchoky kernels, with the average rating 4.8, and the oils from Kyivsky Ananasny and Ananasny Tsiurupynsky kernels received 4.76 and 4.75 respectively.

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РОЗРОБЛЕННЯ ТЕХНОЛОГІЇ ОЛІЙ EXTRA VIRGIN З ЯДЕР КІСТОЧОК РІЗНИХ СОРТІВ АБРИКОСІВ ОДЕСЬКОГО РЕГІОНУ

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Анотація. Досліджено можливість використання ядер абрикосових кісточок (ендокарпій) Одеського регіону сортів Шабловський, Київський ананасний, Ананасний цюрюпінський, Краснощокій як перспективної сировини для отримання олійно-жирової та косметичної продукції. Обґрунтовано технологію олій з ядер кісточок різних сортів абрикосів Одещини. Підібрано технологічні режими холодного пресування Extra Virgin для ядер кісточок різних сортів абрикосів. Волого-теплове оброблення м'ятки із ядер абрикосових кісточок доцільно проводити за температури 40–50 °С протягом 15–20 хвилин. При вилученні олій пресуванням рекомендується не допускати нагрівання мезги вище 50–60 °С протягом 5–7 хвилин. Встановлена ефективність пресування, а саме вміст олій у ядрах абрикосових кісточок сортів Шабловський, Київський ананасний, Ананасний цюрюпінський, Краснощокій складає 33–37%. Від товщини макухової черепашки залежить ефективність пресування. Чим тонша макухова черепашка тим пресування ефективніше: значно зменшується час витримування навантаження, зусилля стиснення та швидкість навантаження, вихід олій збільшується. Тому встановлений етап пресування для ядер кісточок усіх сортів абрикосів найефективніший: при залишковому вмісті олій у макусі 5.0–6.0%, вихід олій – 94.0%, товщина макухової черепашки – 33.0 мм, час витримування навантаження – 3.0 хв., зусилля стиснення – 10.0 kN та швидкість навантаження – 5.0 kN/см. Отримання олій за запропонованим технологічним режимом дозволяє максимально зберегти вихідний жирнокислотний склад сировини. Доведено, що у складі олій, отриманої із ядер абрикосових кісточок сорту «Шабловський», до 96,4% по ω-6 ПНЖК та 95,7% по ω-9 МНЖК. У сорту Київський ананасний до 97,7% по ω-6 ПНЖК та 98,3% по ω-9 МНЖК. У сорту Ананасний цюрюпінський до 96,4% по ω-6 ПНЖК та 93,9% по ω-9 МНЖК. У сорту Краснощокій до 99,0% по ω-6 ПНЖК та 98,4% по ω-9 МНЖК від вихідного.

Ключові слова: ядра абрикосових кісточок; технологія пресування; extra virgin; м'ятка; олія з ядер абрикосових кісточок; макуха з ядер абрикосових кісточок; жирнокислотний склад.