ІННОВАЦІЙНІ ТЕХНОЛОГІЇ ХАРЧОВИХ ВИРОБНИЦТВ

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DEVELOPMENT OF LOW-CALORIE SAUCES WITH DIETARY ADDITIVES

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Abstract. *The article presents a study of the analysis of berry raw materials (sea buckthorn, black currant and lingonberry) for the enrichment of emulsion sauces with antioxidants, in particular vitamins C and E. It was found that berry puree, due to the high content of nutrients in the pulp and skin, is the optimal form for introduction into the composition of sauces. The highest content of dry matter was found in black currant puree (16.39%), while sea buckthorn puree leads in the content of vitamin E (4.7 mg/100 g), and black currant puree – in vitamin C (142.2 mg/100 g). To improve the structure and organoleptic properties of reduced-fat sauces, gum arabic, calcium lactate, eggplant powder, and whey protein concentrate WPC-80 were used. A blended mixture of vegetable oils (sunflower, soybean, corn in the ratio of 15:65:20) with a balanced fatty acid composition (ω-6:ω-3 = 10:1) was developed, which increases the nutritional value of the product. Sauces based on lingonberry puree showed the highest colloidal stability, while sea buckthorn sauces were less stable due to the higher oil content. The slowest increase in peroxide value was observed in sauces with black currant, which confirms their high antioxidant activity. The addition of lecithin contributed to additional stability. The organoleptic and physicochemical parameters of the sauces remained stable for 30 days of storage. The developed sauces are characterized by a high content of vitamins C and E, dietary fiber and calcium, as well as high energy value, especially in sea buckthorn sauces (up to 319.73 kcal/100 g with a fat content of 25%). The introduction of this technology will expand the range and contribute to obtaining a high-quality and safe food product. Based on the nutritional value of the sauces, the developed products can be recommended for inclusion in the diet of all segments of the population, especially workers in hazardous industries and the population of contaminated areas.*

Key words: *mayonnaise, sauces, plant hydrocolloids, gum arabic, dietary fiber, calcium lactate, eggplant powder, whey protein concentrate WPC-80, biotechnology, technology.*

Formulation of the problem in general form. Emulsion fat products are an integral and popular part of the diet of modern man. They give dishes additional flavor shades, juiciness and specificity of taste and aroma. A special place in the assortment of emulsion fat products is occupied by sauces, which are an addition to a large number of dishes. A distinctive feature of such sauces is the content of various aromatic, flavor and coloring food ingredients.

In recent years, the assortment of mayonnaise sauces has only expanded, new production is opening, and competition is growing. Each manufacturer pays great attention to creating new preferences, as well as non-standard packaging to attract the attention of buyers. Now in the assortment of stores you can find mayonnaise sauces with such micronutrients as iron, calcium, vitamin A, and less often vitamin C.

Analysis of recent research and publications. Research by Ukrainian scientists in the field of using berry raw materials to enrich mayonnaise sauces with vitamins C and E is a promising direction in the food industry, aimed at increasing the nutritional value of products and creating functional food systems. Ukrainian scientists are actively investigating the possibilities of enriching mayonnaise sauces with functional ingredients to improve their nutritional value. [1-3]

In the work of Tkachuk Y.V. and Vlasenko V.V., the authors analyze the trends in creating mayonnaise sauces with a balanced composition of physiologically functional ingredients. They note that the addition of biocorrectors contributes to improving the quality of the product, in particular its stability and nutritional properties. [4]

The work of Matveeva T.V. demonstrates an approach to modifying mayonnaises by using oils with a high content of vitamin E. This indicates the interest of Ukrainian researchers in enriching fat emulsions with fat-soluble vitamins, which can be adapted to the introduction of berry extracts as a source of vitamins. [5]

Studies of technologies for enriching products with plant components show that the introduction of berry raw materials requires consideration of its

impact on organoleptic parameters (taste, color, texture) and emulsion stability. In the context of mayonnaise sauces, this may mean the use of berry purees, juices, or extracts. The work of Shtonda O.A. and Pasichny V.M. notes that berry raw materials can adjust the organoleptic properties of products, which is important for adapting the taste of mayonnaise sauces to consumer preferences. [6]

One of the challenges is the instability of vitamin C at high temperatures and in the presence of oxygen, which complicates its preservation in the production of mayonnaise sauces. Vitamin E, as a fat-soluble component, is better integrated into the oil phase of the emulsion, but requires protection from oxidation. Ukrainian scientists Galukh B.I., Paska M.Z., Drachuk U.R. in their studies of the stability of mayonnaise emulsions suggest the use of natural stabilizers, which can be used to preserve vitamins when adding berry raw materials. [7]

Foreign scientists are actively investigating the possibilities of enriching emulsion sauces, such as mayonnaise, with biologically active substances. Chugh B. and Dhawan K. study the stability of oil emulsions with the addition of antioxidants, in particular vitamin E. The authors emphasize that the introduction of natural sources of tocopherols can improve the shelf life of products, which is important for mayonnaise sauces prone to oxidation. This approach can be adapted to berry raw materials, which also contain vitamin E. [8]

The study by Li Y., Zhang L., Wang X., Wu Y., and Zhou J. focuses on the enrichment of mayonnaise with antioxidants from plant sources. Although the authors focus on green tea extracts, their findings on emulsion stability and preservation of antioxidant properties can be applied to berries rich in vitamins C and E. [9]

Berries such as blueberries, raspberries, strawberries, and sea buckthorn are recognized sources of vitamins C and E, as well as other antioxidants. A study by Skrovankova S., Sumczynski D., Mlcek J., Jurikova T., and Sochor J. analyzed the chemical composition of berries and their potential as functional ingredients. The authors noted that berries with high content of ascorbic acid (vitamin C) and tocopherols (vitamin E) can be used to enrich products, including emulsions, due to their ability to neutralize free radicals. [10]

A study by Nile S.H. and Park S.W. highlights that berries not only enrich products with vitamins, but also contribute to improving their bioavailability. This may be key for mayonnaise sauces, where the oil phase promotes the absorption of fat-soluble vitamin E, and the aqueous phase – vitamin C. [11]

The introduction of berry raw materials into mayonnaise sauces is associated with technological challenges, such as vitamin preservation and emulsion stability. Altunkaya A., Hedegaard R.V., Harholt J., Brimer L., Gökmen V. and Skibsted L.H. study the effect of berry phenolic compounds on the oxidative stability of mayonnaise. The authors found that the addition of berry extracts (in particular, from black currant) not only enriches the product with antioxidants, but also extends its shelf life. Although the focus in this study is on phenolics, berries also provide vitamins C and E, which further enhances their effect. [12]

A study by McClements D.J. examines the principles of creating stable emulsions with the addition of plant components. The author notes that berry purees or juices can affect the rheological properties of sauces, necessitating the use of stabilizers, such as xanthan gum, to maintain texture. [13]

Formation of article goals. The purpose of the research is to develop a technology for low-fat sauces with a balanced fatty acid composition using dietary and flavoring additives based on berry puree.

To achieve this goal, the following tasks were solved:

– creating a mixture of vegetable oils for the fat base of an emulsion sauce, balanced in ω-3 and ω-6 fatty acids;

– substantiating the choice of berry raw materials, gum arabic, calcium lactate, determining the possibility of using berry puree in the technology of emulsion fat sauces;

– developing technologies for mayonnaise sauces based on berry puree, gum arabic, calcium lactate;

– developing technological modes for the production of mayonnaise sauce;

– justification of the choice of berry raw materials, gum arabic, calcium lactate, eggplant powder, whey protein concentrate WPC-80, determination of the possibility of using berry puree in the technology of emulsion fat sauces;

– development of mayonnaise sauce technologies based on berry puree, gum arabic, calcium lactate, eggplant powder, whey protein concentrate WPC-80;

– research of the finished product according to organoleptic, physicochemical and microbiological indicators.

Presentation of the main research material. During the study, samples of berries were selected that were most suitable in terms of physicochemical and organoleptic indicators. Sea buckthorn, black currant and lingonberry are promising raw materials for enriching food products with antioxidants.

These berries have a rich chemical composition and have beneficial properties. The introduction of berries into the emulsion sauce is carried out in the form of puree, since most of the nutrients are contained in the pulp and skin of the fruit, which are better preserved when processed into puree than when squeezed juice.

The highest content of dry matter is observed in black currant puree – 16.39%, in sea buckthorn puree – 16.10%, and the lowest – in lingonberry puree – 13.71%.

In terms of vitamin C content, the advantage is the use of black currant puree (142.2 mg/100 g). And in terms of vitamin E content – sea buckthorn puree (4.7 mg/100 g).

The moisture content of the berry puree complies with the standards: sea buckthorn puree – 93%, lingonberry puree – 92%, black currant – 90%. The use of gum arabic and calcium lactate in the composition of emulsion sauces based on berry puree allows you to improve the structure and organoleptic properties of emulsion sauces with reduced fat content. Calcium lactate refers to dietary supplements that are a source of organic calcium that is highly absorbable by the human body. Gum arabic is physiologically functional and has a beneficial effect on the human body.

Adding eggplant powder to the technology is an additional source of vitamins, which is especially important for regulating metabolism and improving the body's resistance to various negative environmental factors. Vitamins are part of enzymes that provide important metabolic processes in the body. Water-soluble vitamins in eggplant powders (PP, B_1, B_2) contribute to cellular metabolism. The mineral composition of eggplant powders contains calcium (48.5±2.0), potassium (740.4±2.0), iron (1.7±0.5), phosphorus (98.80±1.5), magnesium (26.18±2.0), which are a component of bone tissue, have radioprotective and anti-anemic properties, and therefore are vital for humans. The amount of vitamins is, mg/100g: thiamine B_1 – 0.40±0.01; riboflavin B_2 – 0.5±0.06; nicotinic acid PP – 5.22±0.10. The increased level of mineral elements, B vitamins, niacin in eggplant powders will contribute to the overall strengthening of the body and the strengthening of the protective effect of the immune system. And this, in turn, increases the body's resistance to adverse environmental factors.

The use of whey protein concentrate WPC-80 in sauce technology allows you to enrich the product with essential amino acids (BCAA), increasing the biological value of sauces.

Gum arabic is physiologically functional and has a beneficial effect on the human body. Calcium lactate is a food dietary supplement that is a source of organic calcium that is highly digestible by the human body.

A blended mixture of vegetable oils based on berry puree was added to the emulsion sauce. The developed mixture is balanced in terms of fatty acid composition and consists of three types of the most common vegetable oils: sunflower + soybean + corn (15:65:20), where ω-6:ω-3 is 10:1. The resulting blended mixture has a pleasant taste. Due to the balanced composition of PnFA, the developed mixture of oils, when introduced into the emulsion sauce recipe, helps to increase the nutritional value of the finished product.

In the blended oil, the flavor of soybean oil is more pronounced than in the others. As for the smell, there is a very weak note of soybean oil.

All sauces meet the required colloidal stability indicators. The greatest emulsion stability was observed in sauces based on lingonberry puree. Sauces based on sea buckthorn puree are characterized by lower stability, which is due to the content in the berries

All sea buckthorn and black currant sauces can be considered products with a high content of vitamin C (Table 1).

Table 1

Vitamin C content in sauces, 100 g

Fat content	Vitamin C, mg	Vitamin E, mg
Sea buckthorn		
15 %	40,06	1
20 %	40,08	1
25 %	40,08	1
Blackcurrant		
15 %	40,06	0,14
20 %	40,08	0,14
25 %	40,08	0,14
Lingonberry		
15 %	3,06	0,2
20 %	3,08	0,2
25 %	3,08	0,2

Emulsion sauces based on blackcurrant puree are characterized by the slowest increase in peroxide value compared to other sauces. Studies have shown the effectiveness of using blackcurrant and sea buckthorn as raw materials with natural antioxidants. Antioxidants of these sauces have the highest antioxidant activity, as they contain the largest amount of active substances.

After the preparation of emulsion sauces, an organoleptic assessment of each sauce was carried out. In the future, it was carried out every 10 days for 30 days. The analysis was carried out according to the main indicators, and the results are presented in Table 2.

Table 2

Organoleptic evaluation of mayonnaise sauces

Fat content	Cowberry	Blackcurrant	Sea buckthorn
Appearance, consistency			
15 % 20 % 25 %	Homogeneous creamy product, presence of berry particles		
Taste and smell			
15 % 20 % 25 %	The taste is pleasant, slightly sour, with the smell and taste of the added puree		
Color			
15 % 20 % 25 %	Light pink, uniform across the entire surface	Dark cherry, uniform across the entire surface	Light yellow, uniform across the entire surface

The organoleptic characteristics of all sauces remained in their original form for 30 days. The physicochemical characteristics of the sauces were also studied for 30 days. When determining the stability of the sauces, the results obtained on the change in the colloidal stability of the emulsion samples in dynamics (Table 3).

Table 3

Colloidal stability of the studied sauce samples during storage

Sauces / fat content	After cooking, %	After 10 days, %	After 20 days, %	After 30 days, %
Sea buckthorn				
15 %	99,7	99,7	99,7	99,6
20 %	99,7	99,7	99,6	99,5
25 %	99,3	99,3	99,2	99,1
Blackcurrant				
15 %	99,9	99,9	99,8	99,8
20 %	99,9	99,8	99,8	99,8
25 %	99,8	99,7	99,7	99,7
Lingonberry				
15 %	99,9	99,9	99,9	99,9
20 %	99,9	99,9	99,9	99,9
25 %	99,8	99,8	99,8	99,8

All sauces meet colloidal stability. Table 3 shows that the most stable are sauces with the addition of lingonberry puree. Sea buckthorn sauces are considered the most unstable, this is due to the fact that the berry has a higher oil content. The acidity of all developed sauces meets the requirements and is presented in Table 4.

Table 4

Acidity of the last flavors of sauces

Sauces / fat content	After cooking, %	After 10 days, %	After 20 days, %	After 30 days, %
Sea buckthorn				
15 %	0,17	0,17	0,18	0,19
20 %	0,17	0,17	0,19	0,19
25 %	0,18	0,19	0,20	0,20
Blackcurrant				
15 %	0,16	0,16	0,16	0,18
20 %	0,16	0,16	0,18	0,18
25 %	0,16	0,17	0,17	0,19
Lingonberry				
15 %	0,19	0,19	0,20	0,20
20 %	0,19	0,19	0,19	0,20
25 %	0,20	0,20	0,21	0,22

The value of the peroxide value shows the intensity of oxidative processes in the sauce. More precisely, in its fat phase isolated from the emulsion, since in the process of fat oxidation, peroxides and hydroperoxides decompose into free radicals. The antioxidant should prevent the values of this indicator from increasing during storage.

Figure 1 shows that in mayonnaise sauces with a fat content of 15%, lingonberry sauce has the highest peroxide value. The minimum value is characteristic of blackcurrant puree sauce.

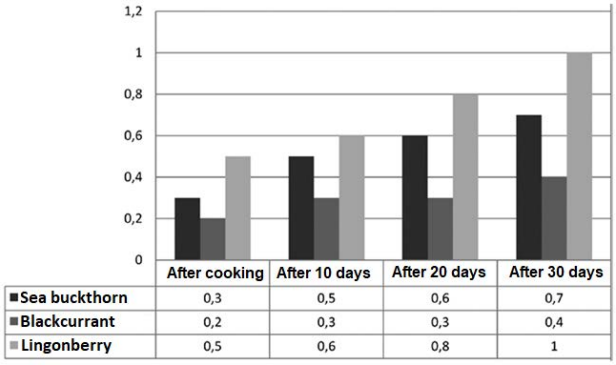

Fig. 1. Peroxide value indicators in sauces with 15% fat content

Figure 2 shows that in emulsion sauces with a fat content of 20%, lingonberry sauce has the highest peroxide value. The minimum value is characteristic of blackcurrant puree sauce

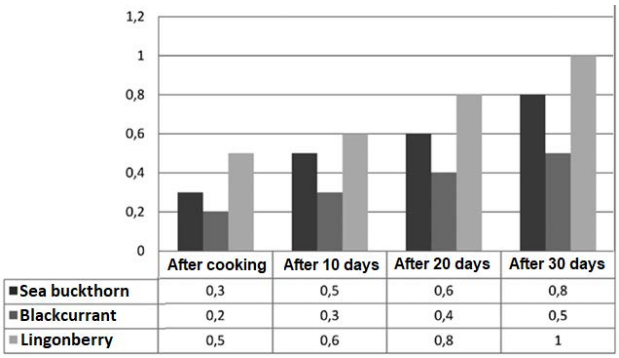

Fig. 2. Peroxide value indicators in sauces with 20% fat content

Figure 3 shows that in mayonnaise sauces with a fat content of 25%, lingonberry sauce has the highest peroxide value. The lowest peroxide value belongs to the sauce with blackcurrant puree. It can be concluded that in sauces with blackcurrant the increase in peroxide value occurs more slowly than in other sauces.

The quality of food products is of key importance in terms of their impact on human health and life expectancy. Antioxidant activity can be considered as one of the aspects of food quality. Oxidation resistance was determined by the accelerated oxidation method, by indicating the oxidation induction time, the value of which is inversely dependent on the intensity of oxidative processes.

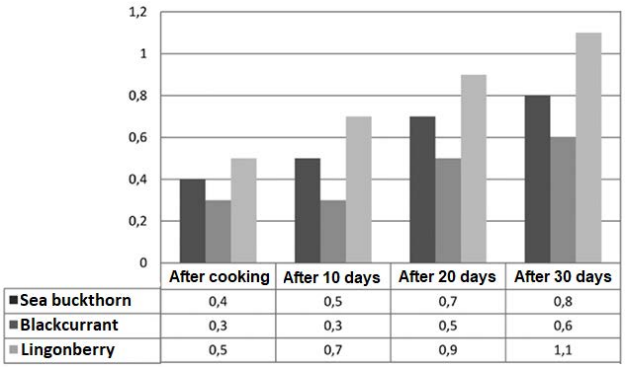

Fig. 3. Peroxide value indicators in sauces with 25% fat content

The results of the experiment allowed us to determine the following compositions: mixed systems with the highest oxidation resistance at 120 °C; control sample – a mixture of source oils (sunflower oil 15% + soybean oil 65% + corn oil 20%). The control induction time was 2.9 hours, and in the fat phase of the finished sauces, the oxidation resistance increased. This means that the introduction of berry purees with their own natural antioxidants increases the resistance to oxidation of fats (Fig. 4)

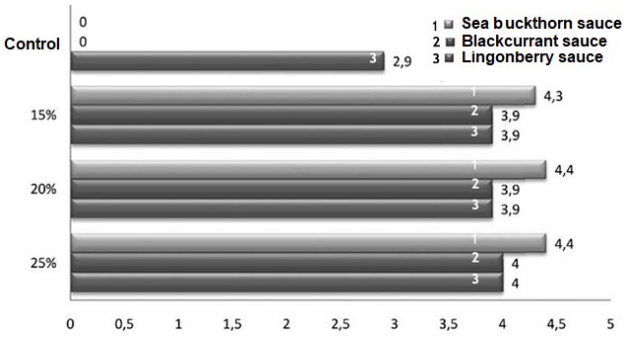

Fig. 4. Induction time of mayonnaise sauces

Based on the results of the induction time, antioxidant activity (AOA) was calculated. Studies have shown the effectiveness of using black currant and sea buckthorn as raw materials with natural antioxidants (Fig. 5).

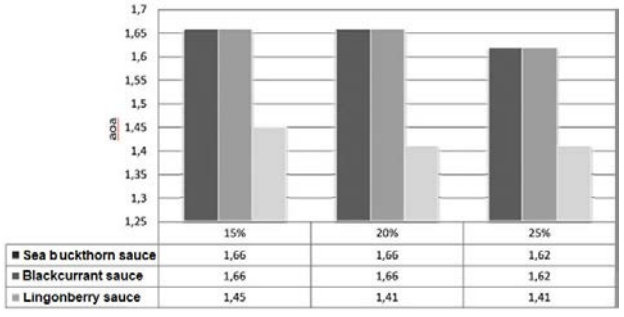

Fig. 5. Results of antioxidant activity of mayonnaise sauces

Antioxidants of these sauces have the highest antioxidant activity, as they contain the largest amount of active substances. To increase the shelf life, antioxidants and preservatives were added to the sauce recipe in further studies.

The nutritional value of the sauces is enriched with vitamins C and E, as well as dietary fiber through the use of gum arabic. The developed sauces can be considered products with a high content of dietary fiber and calcium. Energy value is a quantitative characteristic of food products, also called calorie content. This is the amount of energy that is released with food in the human body during digestion. The highest energy value is observed in sea buckthorn sauces (Table 5).

Table 5

Energy value of sauces

Sauce / Fat content	Energy value, kcal/kJ		
	Sea buckthorn	Blackcurrant	Lingonberry
15 %	275,35/1153	267,75/1121	268,15/1123
20 %	306,73/1284	299,13/1252	299,53/1254
25 %	319,73/1339	312,13/1307	312,53/1309

Conclusions on the above problems and prospects for further research in the given direction. The recipe and technology of low-fat sauces containing dietary and flavoring additives have been developed. Based on the conducted research, the choice of berry raw materials and dietary supplements for the production of emulsion sauces has been substantiated. The introduction of dietary supplements, gum arabic, calcium lactate, eggplant powder, and whey protein concentrate WPC-80 helps enrich sauces with nutrients. Emulsion sauces based on sea buckthorn berry puree and black currant puree can be stored for 90 days, which meets the quality requirements. The shelf life of emulsion sauce based on lingonberry puree is 70 days, which is due to the content of smaller amounts of vitamins C and E in the berry puree, which, in turn, play the role of additional antioxidants in the case of emulsion sauces based on sea buckthorn and black currant berry puree. The choice of gum arabic, calcium lactate, eggplant powder, and whey protein concentrate WPC-80 was justified, the introduction of which had the greatest impact on the consistency and colloidal stability of sauces. A composite mixture of vegetable oils balanced in ω-3 and ω-6 fatty acids was created: sunflower + soybean + corn (15:65:20), where ω-6:ω-3 = 10:1. The study of the quality indicators of berry raw materials meets the standards. It was established which of the sauces with the addition of berry puree have the best antioxidant resistance.

BIBLIOGRAPHY

1. Черевко О.І. Інноваційні технології харчової продукції функціонального призначення. Харків: ХДУХТ, 2017. 591 с.

2. Igor Dudarev, Oleh Kuzmin, Nataliia Stukalska etc. Using oat milk to reduce the caloric value of a functional mayonnaise sauce. *Acta Sci. Pol. Technol. Aliment.* 2014. Vol. 23. № 1. P. 29–38.

3. Галицька Л.Ю., Хижняк О.О. Нетрадиційна олієвмісна сировина в Україні. *Технічні науки: стан, досягнення і перспективи розвитку м'ясної, олієжирової та молочної галузей:* матеріали 3 Міжнародної науково-технічної конференції. Київ: НУХТ, 2014. С. 144–146

4. Ткачук Ю.В., Власенко В.В. Дослідження якості емульсії майонезних соусів, збагачених біокоректорами. *Наукові праці ОНАХТ*, 2018. № 1. С. 123–130.

5. Матвєєва, Т. В. (2015). Розробка рецептури майонезу на основі купажованих олій для функціонального харчування. *Вісник НТУ «ХПІ». Серія: Нові рішення в сучасних технологіях*, 2015. № 1. С. 55–59.

6. Штонда О.А., Пасічний В.М. Перспективи використання фруктово-ягідної сировини у технології м'ясних натуральних напівфабрикатів. *Наукові праці Національного університету харчових технологій*, 2019. № 6. С. 45–52.

7. Галух Б.І., Паска М.З., Драчук У.Р. (2015). Дослідження стійкості майонезних емульсій, виготовлених із використанням харчових волокон. *Вісник НТУ «ХПІ». Серія: Нові рішення в сучасних технологіях*, 2015. № 4. С. 55–59.

8. Chugh B., Dhawan K. Storage studies on mustard oil blends. Journal of Food Science and Technology, 2014. Vol. 51. Vol. 4. P. 762–767.

9. Li Y., Zhang L., Wang X., Wu Y., & Zhou J. Development of functional mayonnaise enriched with antioxidants. *Journal of Food Processing and Preservation*, 2018. Vol. 42. № 5. P. 34–45

10. Skrovankova S., Sumczynski D., Mlcek J., Jurikova T., Sochor J. Bioactive compounds and antioxidant activity in different types of berries. *International Journal of Molecular Sciences*, 2015. Vol. 16. № 10. P. 73–106

11. Nile S.H., Park S.W. (2014). Edible berries: Bioactive components and their effect on human health. *Nutrition*, 2014. Vol. 30. № 2. P. 134–144.

12. Altunkaya A., Hedegaard R. V., Harholt J., Brimer L., Gökmen V., & Skibsted L.H. Oxidative stability of mayonnaise enriched with berry phenolics. *Food Chemistry*, 2013. Vol. 141. № 3. P. 209–215.

13. McClements D. J. Food emulsions: Principles, practices, and techniques (3rd ed.). CRC Press. 2015. P. 467

REFERENCES

1. Cherevko, O. I. (2017). Innovatsiini tekhnolohii kharchovoi produktsii funktsionalnoho pryznachennia [Innovative technologies for functional food products]. Kharkiv: KhDUKhT. [in Ukrainian].

2. Dudarev, I., Kuzmin, O., Stukalska, N., & et al. (2024). Using oat milk to reduce the caloric value of a functional mayonnaise sauce. *Acta Scientiarum Polonorum Technologia Alimentaria*, 23(1), 29–38.

3. Halytska, L. Yu., & Khyzhniak, O. O. (2014). Netradytsiina oliievmsina syrovyna v Ukraini [Non-traditional oil-containing raw materials in Ukraine]. Tekhnichni nauky: stan, dosiahnennia i perspektyvy rozvytku miasnoi, oliiezhyrovoi ta molochnoi haluzei: materialy 3 Mizhnarodnoi naukovo-tekhnichnoi konferentsii (pp. 144–146). Kyiv: NUHT. [in Ukrainian].

4. Tkachuk, Yu. V., & Vlasenko, V. V. (2018). Doslidzhennia yakosti emulsiї majoneznykh sousiv, zbahachenykh biokorektoramy [Study of the quality of mayonnaise sauce emulsions enriched with biocorrectors]. *Naukovi pratsi ONAKhT*, (1), 123–130. [in Ukrainian].

5. Matvieieva, T. V. (2015). Rozrobka retseptury majonezu na osnovi kupazhovanykh olij dlia funktsionalnoho kharchuvannia [Development of a mayonnaise recipe based on blended oils for functional nutrition]. *Visnyk NTU "KhPI". Seriia: Novi rishennia v suchasnykh tekhnolohiiakh*, (1), 55–59. [in Ukrainian].

6. Shtonda, O. A., & Pasichnyi, V. M. (2019). Perspektyvy vykorystannia fruktovo-yahidnoi syrovyny u tekhnolohii m'iasnykh pryrodnykh napivfabrykativ [Prospects for using fruit and berry raw materials in the technology of natural meat semi-finished products]. *Naukovi pratsi Natsionalnoho universytetu kharchovykh tekhnolohii*, (6), 45–52. [in Ukrainian].

7. Halukh, B. I., Paska, M. Z., & Drachuk, U. R. (2015). Doslidzhennia stijkosti majoneznykh emul'sij, vyhotovlenykh iz vykorystanniam kharchovykh volokon [Study of the stability of mayonnaise emulsions made using dietary fibers]. *Visnyk NTU "KhPI". Seriia: Novi rishennia v suchasnykh tekhnolohiiakh*, (4), 55–59. [in Ukrainian].

8. Chugh, B., & Dhawan, K. (2014). Storage studies on mustard oil blends. Journal of Food Science and Technology, 51(4), 762–767.

9. Li, Y., Zhang, L., Wang, X., Wu, Y., & Zhou, J. (2018). Development of functional mayonnaise enriched with antioxidants. *Journal of Food Processing and Preservation,* 42(5), 34–45.

10. Skrovankova, S., Sumczynski, D., Mlcek, J., Jurikova, T., & Sochor, J. (2015). Bioactive compounds and antioxidant activity in different types of berries. *International Journal of Molecular Sciences*, 16(10), 73–106.

11. Nile, S. H., & Park, S. W. (2014). Edible berries: Bioactive components and their effect on human health. *Nutrition*, 30(2), 134–144.

12. Altunkaya, A., Hedegaard, R. V., Harholt, J., Brimer, L., Gökmen, V., & Skibsted, L. H. (2013). Oxidative stability of mayonnaise enriched with berry phenolics. *Food Chemistry*, 141(3), 209–215.

13. McClements, D. J. (2015). Food emulsions: Principles, practices, and techniques (3rd ed.). CRC Press.

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Анотація. *У статті проведено дослідження аналіуз ягідної сировини (обліпихи, чорної смородини та брусниці) для збагачення емульсійних соусів антиоксидантами, зокрема вітамінами С і Е. Встановлено, що ягідне пюре, завдяки високому вмісту корисних речовин у м'якоті та шкірці, є оптимальною формою введення до складу соусів. Найвищий вміст сухих речовин виявлено в пюре з чорної смородини (16,39%), тоді як пюре з обліпихи лідирує за вмістом вітаміну Е (4,7 мг/100 г), а з чорної смородини – за вітаміном С (142,2 мг/100 г). Для покращення структури та органолептичних властивостей соусів зі зниженим вмістом жиру використано гуміарабік, лактат кальція, порошок з баклажанів, концентрат білковий молочної сироватки WPC-80. Розроблено купажовану суміш рослинних олій (соняшникова, соєва, кукурудзяна у співвідношенні 15:65:20) зі збалансованим жирнокислотним складом (ω-6:ω-3 = 10:1), що підвищує поживну цінність продукту. Соуси на основі брусничного пюре показали найвищу колоїдну стабільність, тоді як соуси з обліпихи виявилися менш стійкими через вищий вміст олій. Найповільніше зростання перекисного числа спостерігалося в соусах із чорною смородиною, що підтверджує їхню високу антиоксидантну активність. Додавання лецитину сприяло додатковій стабільності. Органолептичні та фізико-хімічні показники соусів залишалися стабільними протягом 30 діб зберігання. Розроблені соуси характеризуються підвищеним вмістом вітамінів С і Е, харчових волокон і кальцію, а також високою енергетичною цінністю, особливо в соусах з обліпихи (до 319,73 ккал/100 г при жирності 25%). Впровадження цієї технології розширить асортимент і сприятиме отриманню якісного та безпечного харчового продукту. Виходячи з харчової цінності соусів, розроблені продукти можна рекомендувати для включення в раціон харчування всіх верств населення, особливо працівників шкідливих виробництв і населення забруднених територій.*

Ключові слова: *майонез, соуси, рослинні гідроколоїди, гуміарабік, харчові волокна, лактат кальція, порошок з баклажанів, концентрат білковий молочної сироватки WPC-80, біотехнологія, технологія.*

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