ІННОВАЦІЙНІ ПРОЦЕСИ ХАРЧОВИХ ВИРОБНИЦТВ

UDC 664.8/.9:639.21:663.05
DOI https://doi.org/10.37734/2518-7171-2025-2-7

CHANGE IN STRUCTURAL, MECHANICAL, AND ORGANOLEPTIC CHARACTERISTICS OF FRESHWATER FISH MEAT UNDER THE INFLUENCE OF ORGANIC ACIDS

N. B. HOLEMBOVSKA, Candidate of Technical Sciences, Associate Professor
V. M. ISRAELIAN, Candidate of Technical Sciences, Associate Professor
(National University of Life and Environmental Sciences of Ukraine)

Abstract. *The article explores the influence of acetic acid at various concentrations (0.5%, 0.7%, 1.0%, and 1.5%) on freshwater fish meat's structural, mechanical, and organoleptic characteristics, using carp (Cyprinus carpio) as the study object. The research aimed to identify optimal technological parameters for using acetic acid to enhance carp meat's maturation and sensory qualities in preserve production. The study's relevance lies in addressing the limited endogenous proteolytic activity of freshwater fish species, which restricts the development of desired texture and flavor without additional processing interventions.*

After preliminary salting, carp fillets were subjected to acid treatment for 30, 60, and 90 minutes. Standardized methods assessed key indicators such as pH, ultimate shear stress (USS), and sensory properties (texture, taste, aroma, color). The findings showed that treatment with 1.0% acetic acid for 60 minutes yielded the most favorable results: the meat achieved a soft, juicy texture, developed a pleasant aroma and color, and received the highest sensory scores. A significant decrease in USS indicated improved tenderness and activation of endogenous enzymes, while pH values shifted steadily toward the acidic range, confirming biochemical modifications in the muscle tissue.

However, extended exposure (90 minutes) or higher concentrations (1.5%) led to partial denaturation, loss of tenderness, and visible surface changes. The optimal treatment parameters allow for adequate maturation while maintaining product quality. These results provide a scientific basis for the technological application of acetic acid in fish preserve manufacturing using locally sourced freshwater species. The proposed approach contributes to the development of affordable, high-quality, functional fish products with enhanced nutritional and sensory properties, aligning with sustainable food production goals.

Key words: *organic acids, ultimate shear stress, hydrobionts, organoleptic parameters, freshwater fish.*

Introduction. A pressing issue today is ensuring the population has access to high-quality food products with significant nutritional and biological value. This challenge arises from nutritional status disturbances and essential nutrient deficiencies [1, 2]. Consequently, developing new, chemically balanced food products enriched with functional ingredients, while maintaining their stability and safety throughout processing and storage, is gaining growing importance [3].

The current nutritional status of the Ukrainian population calls for developing and implementing product technologies based on natural raw materials with a predictable composition, as existing products often fail to meet essential nutritional requirements [4]. In Ukraine, the volume of freshwater fish farming and fishing is growing, yet the product range remains limited mainly to live and chilled fish. The organoleptic qualities and nutritional value of freshwater fish necessitate improvements in processing technologies, particularly by integrating plant-based raw materials [5, 6].

The shift in Ukraine's raw material base towards expanding freshwater aquaculture has created a demand to diversify food products derived from these aquatic organisms. Freshwater fish generally have lower nutritional and biological value compared to marine fish [7]. Therefore, recent research efforts have focused extensively on developing freshwater fish products enriched with plant ingredients and animal-origin raw materials to enhance their nutritional profile and regulate functional properties [2].

Carp is one of the most intensively farmed fish species in our country. This fish is rich in protein containing all essential amino acids and biologically active fatty acids. However, according to modern dietary requirements, its meat has a low content or absence of dietary fiber and certain trace elements essential for nutrition. Additionally, freshwater fish generally have a mild taste, highlighting the need to improve their flavor profile [8, 9]. Ukraine cultivates various spicy and aromatic root vegetables, which are only partially utilized in fish product technologies. Previous studies have demonstrated that incorporating plant raw materials, including spicy and aromatic root crops, into freshwater fish processing helps harmonize organoleptic qualities and create food products with functional properties [10].

Despite this, there has been no systematic research on activating the maturation processes of freshwater fish in preserved products. Therefore, developing preservation technologies that combine freshwater fish and spicy-aromatic root vegetables is urgent. Solving this issue will enable producing high-quality, safe, and biologically valuable fish and vegetable products from domestic raw materials while expanding the range of products made from freshwater fish [11].

An analysis of current trends in fish product technologies highlights several key areas: the development of polycomponent food products, enhancement of preservation methods for slowly maturing aquatic organisms, enrichment of product formulations, diverse raw material pre-treatment techniques, and the application of physical, chemical, and biotechnological methods in producing traditional fish-based foods such as canned goods, preserves, pâtés, salted and dried products, culinary dishes, and washed minced fish products.

It is well established that using enzyme preparations during fish salting can improve the quality of products made from immature fish species. In fish preserve production, costly enzyme preparations derived from plant and microbial sources are employed, such as the culture fluid of *Halomonas mediterranei* for tenderizing pollock meat or the proteolytic enzyme preparation Sal Intersor EC for manufacturing fish fillet preserves.

Research by these scientists has demonstrated that certain marine hydrobionts possess highly active complexes of proteolytic enzymes with broad potential applications. In contrast, the muscle tissue of freshwater fish species exhibits low endogenous proteinase activity, which hinders achieving the desired degree of maturation without the additional use of proteolytic enzyme preparations to accelerate this process [12].

Considerable interest has been shown in the technology for producing preserves from non-fish aquatic species, specifically squid and rapana, which are slow-maturing raw materials [8, 9, 11]. The technology for making preserves from these mollusks involves pre-treatment methods such as blanching or microwave processing to soften the meat texture.

The effectiveness of processing fish preserves using orange juice, which promotes their maturation, has also been demonstrated. Adding orange juice as a food additive imparts functional properties to the preserves by enriching them with biologically active substances, including vitamins C, PP, B-complex vitamins, beta-carotene, and minerals like potassium, calcium, iron, and selenium [13].

The reviewed technologies for processing fish raw materials highlight promising opportunities to improve preservation production by better maintaining the natural qualities of the raw materials, primarily due to the absence of heat treatment [11].

Given the changes in the fisheries structure, including a general decline in catches of traditional marine fish species and a rise in the use of freshwater fish in aquaculture, there is a growing need to enhance integrated raw material processing methods and expand the range of freshwater fish-based food products [14]. One of the most promising approaches to address these challenges is the development of freshwater fish preserves based on the principles of food combinatorics, enriching them with plant ingredients. Incorporating spicy and aromatic root vegetables is a priority area for future research.

The technology of preserves made from slow-maturing hydrobionts involves using factors that activate the fish muscle's endogenous enzyme systems, contributing to developing the product's characteristic "bouquet." [15, 16].

Additionally, organic acids (such as acetic, tartaric, citric, and malic acids) are increasingly employed in producing many products, including preserves, to enhance safety during storage, as existing scientific studies support. However, further research is required to determine the optimal concentrations of these acids, balancing safety with the stimulation of maturation, considering the specific properties of different raw materials [17].

Creating new, chemically balanced food products enriched with functional components that maintain their safety and quality after processing and during storage is of growing importance. Based on a synthesis of theoretical knowledge, this article justifies using organic acids in the technology of freshwater fish preserves, which promotes the maturation of salted semi-finished products and enables food production with superior organoleptic qualities and enhanced biological value.

Materials and methods of the research

Samples. Live fish caught in spring and autumn (carp) in accordance with DSTU 2284 [18], grown in the reservoirs of PJSC Cherkasyrybhosp; table salt in accordance with DSTU 3583 [19]; table vinegar in accordance with DSTU 2450 [20].

Laboratory Methods. The water index (pH, active acidity) was determined using the potentiometric method [21, 22].

The organoleptic evaluation of the fillets was carried out in several stages throughout the processing period according to our improved five-point scale, which contains five primary quality levels for each indicator: 5 points – excellent quality level; 4 points – good quality level; 3 points – satisfactory; 2 points – unsatisfactory; 1 point – poor quality product.

The ultimate shear stress (USS) value was determined by a Ulab 3-31 M penetrometer at room temperature, exposure for 5 s, in identical measuring vessels using a measuring cone with a vertex angle of $2\alpha=60^{\circ}$.

The size of the USS was calculated using the following formula:

$$\theta = \kappa \cdot m \cdot h^{-2},$$

where θ is the ultimate shear stress, Pa;
m is the mass of the cone with the rod and additional weight, kg;
κ is the constant of the measuring cone (for the cone with an angle at the vertex of 2 α = 60 º k = 2.1 H/kg);
h is the depth of the cone immersion at 5 s exposure, m.

Description of the Experiment. The carp were cut into fillets, which were salted with a nodule pickle until they reached 5 % salt at room temperature for 24 hours. Then the fillets were treated with organic acids of different concentrations.

The preserved formulations of the control samples comprised carp meat (75 %) and filling (25 %). The preserved samples were stored in 200 cm^3 plastic containers at 0 to + 4 °C.

Then, an average sample was taken from each unit, which was then characterised by organoleptic evaluation, pH, and ultimate shear stress after grinding. The study was conducted in 5 replicates, and the experimental data were processed using mathematical statistics.

Results. The technology of preserves made from slowly ripening aquatic organisms involves using factors that activate the muscle tissue's endogenous enzyme system, contributing to developing the product's characteristic "bouquet". Meanwhile, organic acids such as acetic acid are increasingly employed in producing many products, including preserves, to enhance product safety during storage, as demonstrated by various scientific studies. However, due to the specific nature of different raw materials, further research is necessary to understand the effects of varying acid concentrations on ensuring safety and stimulating maturation.

This study aimed to investigate the patterns of change in a range of indicators in carp meat when exposed to different acid concentrations during refrigerated storage at 0 to 5 °C, with a processing time of 90 minutes. Organoleptic evaluation of carp meat treated with varying concentrations of acetic acid showed a positive effect dependent on the duration of processing (Fig. 1).

No significant organoleptic changes were observed between the control and experimental samples at the initial processing stage. However, after 30 minutes of treatment, the organoleptic qualities of the experimental samples improved compared to the power, particularly at acetic acid concentrations between 0.7% and 1.5%. Carp meat pieces treated with varying concentrations of acetic acid showed a noticeably better appearance than the control samples. After 30 minutes of acid exposure, improvements were noted in taste, aroma, and color (see Fig. 2). The texture across all variants was soft, very tender, and juicy; however, after 90 minutes of processing, the texture became less smooth and tender, with visible signs of a white coating.

The best results in texture softening and taste, aroma, and color development were observed in samples treated with 1.0% acetic acid for 60 minutes. These samples developed a soft texture, with the meat becoming very tender, juicy, and scoring a five on the

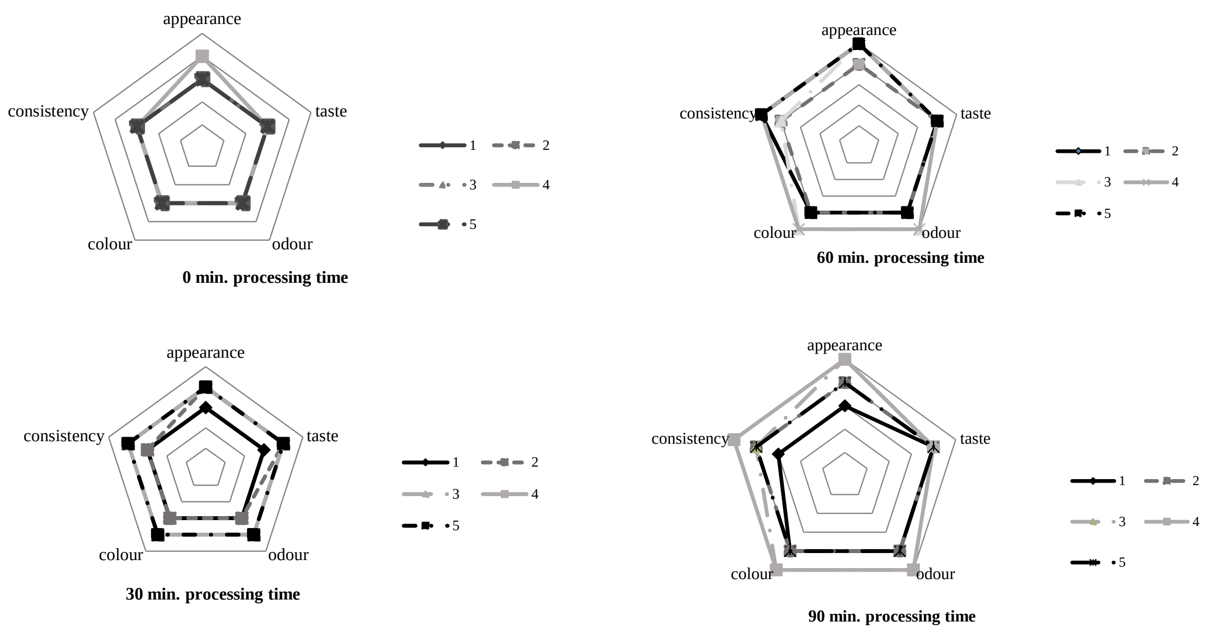

Fig. 1. Dynamics of changes in the organoleptic evaluation of carp meat under the influence of different concentrations of acetic acid depending on the processing time (n = 5, p ≤ 0.05): 1 – control; 2 – C = 0.5 %; 3 – C = 0.7 %; 4 – C = 1.0 %; 5 – C = 1.5 %

organoleptic scale. Thus, the organoleptic evaluation indicates that acetic acid positively affects carp meat in all experimental samples, with the most pronounced effect seen at concentrations between 0.7% and 1.0%.

Changes in the shear stress (USS) of carp muscle tissue treated with acetic acid are illustrated in Fig. 1.2. While the shear stress in the control sample changed linearly, all experimental samples exhibited a parabolic change (Fig. 1.2).

Analysing the data, we concluded that the effect of all concentrations of acetic acid is accompanied by a more significant decrease in the USS value compared to the control sample, which indicates the impact of acid on carp meat, resulting in its softening. A gradual reduction in this indicator is observed up to 60 min, after which it increases again.

The dependence of y = f(x) in carp is $y = 1036x^2 – 6235x + 14728$ at a concentration of acetic acid of 0.5 %; $y = 1184x^2 – 184x + 15606$ at a concentration of 0.7 %; $y = 1454x^2 – 8789x + 16838$ at a concentration of 1.0 %; $y = 1558x^2 – 9762x + 17621$ at a concentration of 1.5 % and $y = 36x^2 – 812x + 10244$ and the control sample. At all concentrations of acetic acid, the value of the approximation coefficient R^2 is greater than 0.90, indicating the trend line's correctness.

It was established that the softening of meat texture under the influence of acids is accompanied by a decrease in pH towards acidity and the activation of cathepsin enzymes. The results of our research align with these findings. The pH changes in carp meat treated with all tested concentrations of acetic acid followed a linear trend, gradually shifting from 6.8 to 4.3 toward the acidic range (see Fig. 3).

At the same time, the indicator of changes in the consistency of meat – USS indicates that after 60 minutes of acid treatment, the consistency is compacted against the background of a gradual change in pH to the acidic side and organoleptic evaluation of softening of the consistency (Fig. 3). These contradictions can be explained by the fact that with the extension of the acid treatment of carp meat, both protein hydrolysis and denaturation processes co-occur.

Conclusions. The study confirms the effectiveness of using acetic acid to improve the structural, mechanical, and sensory characteristics of freshwater fish meat, specifically carp. The optimal treatment was identified as immersion in 1.0% acetic acid for 60 minutes, which resulted in the highest organoleptic scores due to improved tenderness, juiciness, color, and aroma. This treatment also led to a significant reduction in ultimate shear stress, indicating desirable softening of the muscle tissue, and was accompanied by a controlled decrease in pH values, contributing to the activation of endogenous proteolytic enzymes.

At higher concentrations or prolonged exposure times, partial denaturation of proteins and surface defects were observed, which negatively affected the texture and appearance of the product. Therefore, careful selection of acetic acid concentration and treatment duration is crucial to balancing quality enhancement with preserving natural meat characteristics.

The findings provide a scientific basis for incorporating acetic acid into the processing of freshwater fish preserves, offering a cost-effective and natural method to accelerate maturation and improve product quality without external enzymatic additives. This approach supports the development of safe, nutritious, and sensory-attractive fish products from local aquatic resources. It can be applied in industrial settings to expand the range of functional, value-added fish products.

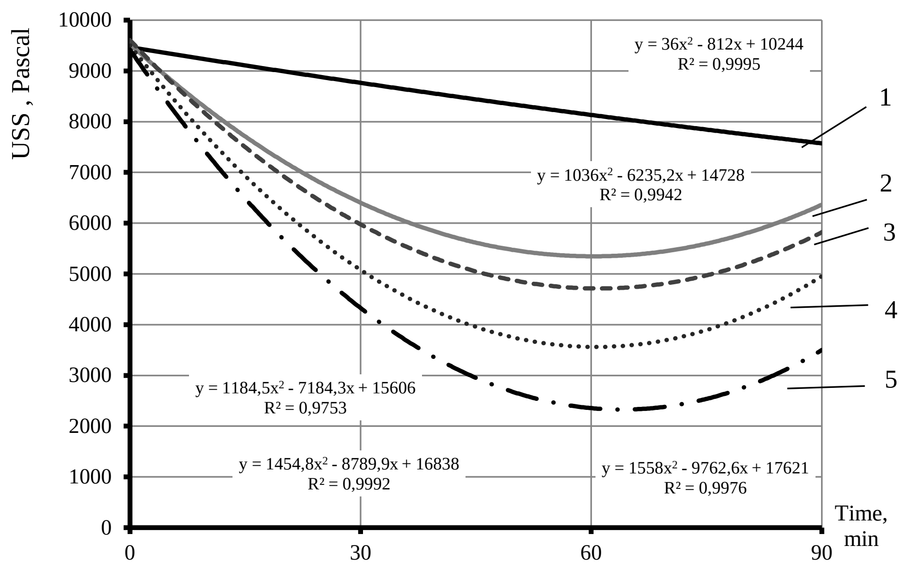

Fig. 2. Dependence of carp meat USS on the effect of different concentrations of acetic acid for 90 minutes (n=5, p≤0.05): 1 – control; 2 – C=0.5 %; 3 – C=0.7 %; 4 – C=1.0 %; 5 – C=1.5 %

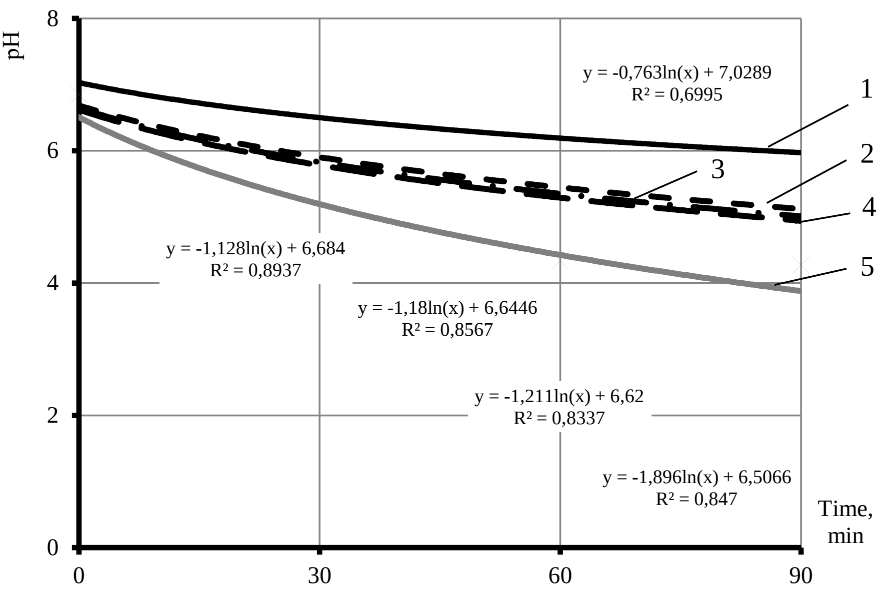

Fig. 3. Dynamics of changes in pH of carp meat under the influence of different concentrations of acetic acid depending on the processing time (n = 5, p ≤ 0.05): 1 – control; 3 – C = 0.7 %; 4 – C = 1 %; 5 – C = 1.5 %

BIBLIOGRAPHY

1. Бондарець Т. Г., Гнітій Н. В. Фізико-хімічні показники якості пресервів з філе оселедця. *Актуальні питання розвитку економіки, харчових технологій та товарознавства*, С. 293.

2. Statkevych O. I., Kolomiiets Y. V., Holembovska N. V., Israelian V. M., Babych O. A., Slobodyanyuk N. M., Babytskiy A. I., Statkevych A. O. Effects of nutrient medium on various-age larvae of Hermetia illucens (Diptera, Stratiomyidae*). Regulatory Mechanisms in Biosystems*, 2024. №15(4), PP. 907-911. https://doi.org/10.15421/0224131

3. Ezzat M.A., Ghazali M.H., Roselina K., Zare D. Organic acid composition and consumer acceptability of fermented fish produced from black tilapia (Oreochromis mossambicus) and Javanese carp (Puntius gonionotus) using natural and acid-assisted fermentation. *Food Research*, 2021. 5(2), PP. 262-271. doi: 10.26656/fr.2017.5(2).583.

4. Holembovska N., Tyshchenko L., Slobodyanyuk N., Israelian V., Kryzhova Y., Ivaniuta A., Pylypchuk O., Menchynska A., Shtonda O., Nosevych D. Use of aromatic root vegetables in the technology of freshwater fish preserves. *Potravinarstvo Slovak Journal of Food Sciences,* 15, 2021. PP. 296-305. doi: 10.5219/1581.

5. Vieira H.P., Barrros C.N., Mendes E.S., Maciel M.I.S., Andrade H.A., Oliveira Filho P.R.C. Development and characterization of fresh sausages made with marine catfish Sciades herzbergii (Bloch, 1794). *Acta Scientiarum. Technology*, 2019. №41(1). doi:10.4025/actascitechnol.v41i1.40299.

6. Hananiah N., Rahim A.A. The application of hurdle technology in extending the shelf life and improving the quality of fermented freshwater fish (Pekasam): *A review. Malaysian Journal of Science Health & Technology,* 2022. 8(1), PP. 44-54. doi: 10.33102/2022240.

7. Dorozhko V., Holembovska N., Slobodianiuk N., Israelian V., Stetsyuk I., Pylypchuk O., Omelian A., Rudyk Y. Enhancing fish pâté with non-traditional ingredients: maca root, broccoli, and beetroot. *Scifood*, 2025. *19*(1), PP. 192-207. https://doi.org/10.5219/scifood.24

8. Новікова Н., Єфимова А., Лещик О. Вивчення харчової та біологічної цінності пресервів покращеної якості. *Таврійський науковий вісник. Серія: Технічні науки.* 2023. doi:10.32782/tnv-tech.2023.2.22.

9. Liu X., Ji L., Zhang T., Xue Y., Xue C. Effects of pre-emulsification by three food-grade emulsifiers on the properties of emulsified surimi sausage. *Journal of Food Engineering,* 2019. PP. 30-37. doi: 10.1016/j.jfoodeng.2018.11.018.

10. Sadeghinejad N., Sarteshnizi R.A., Gavlighi H.A., Barzegar M. Pistachio green hull extract as a natural antioxidant in beef patties: Effect on lipid and protein oxidation, color deterioration, and microbial stability during chilled storage. *Food Science and Technology*, 2019. №102, PP. 393-402. doi: 10.1016/j.lwt.2018.12.060.

11. Победаш М. М. Актуальні проблеми ринку рибних пресервів України. *Інтегроване управління водними ресурсами: наук. зб*, 2013. 499–503.

12. Wang Y., Chen Q., Li L., Chen S., Zhao Y., Li C., Sun-Waterhouse D. Transforming the fermented fish landscape: Microbiota enable novel, safe, flavorful, and healthy products for modern consumers. *Comprehensive Reviews in Food Science and Food Safety*, 2023. 22(5), P. 3560. doi:10.1111/1541-4337.13208.

13. Rodak O., Fil M. Development of fish preserves high biological value. *Scientific Messenger LNUVMBT named after S.Z. Gzhytskyj*, 2014. №18(2), PP. 79-82. doi:10.15421/nvlvet6815.

14. Pobedash M.M., Sydorenko O.V. Ways of stabilization of the consumer properties of fish preserves based on small herring fish. *Bulletin of the Chernihiv University of Technology Series: Technical Sciences*, 2014. №2, PP. 208-212.

15. Veloso R.R., dos Anjos B.W., Maciel M.I.S., Shinohara N.K.S., Andrade H.A., Oliveira Filho P.R.C. Development and evaluation of fresh sausage type of marine catfish stored under low temperatures. *International Food Research Journal*, 2019. №26(2), PP. 619-629.

16. Nikoo M., Regenstein J.M., Noori F., Gheshlaghi S.P. Autolysis of rainbow trout (Oncorhynchus mykiss) by-products: Enzymatic activities, lipid and protein oxidation, and antioxidant activity of protein hydrolysates. *Food Science and Technology*, 2021. 140(1), P. 110. doi: 10.1016/j.lwt.2020.110702.

17. You S., Yang S., Li L., Zheng B., Zhang Y., Zeng H. Processing technology and quality change during storage of fish sausages with textured soy protein. Foods, 2022. 11(22), Article number 3546. doi:10.3390/foods11223546.

18. ДСТУ 2284-95. Риба жива. Загальні технічні умови. Київ: Видавництво стандартів, 20 с.

19. ДСТУ 3583-97. Сіль кухонна. Загальні технічні умови. Київ: Видавництво стандартів, 60 с.

20. ДСТУ 2450-2006. Оцти з харчової сировини. Загальні технічні умови. Київ: Державний комітет України з питань стандартизації та метрології, 23 с.

21. Ткаченко О. Б., Каменєва Н. В., Тітлова О. О. Основи сенсорного аналізу харчових продуктів. Одеса, 2020. 310 с.

22. Слободянюк Н. М., Голембовська Н. В., Менчинська А. А., Андрощук О. С., Тулуб Д. О. Технологія переробки риби. Київ: КП «Компринт», 2018. 264 с.

REFERENCES

1. Bondarets, T. H., & Hnitii, N. V. (2019). Fizyko-khimichni pokaznyky yakosti preserviv z file oseledtsia. aktualni pytannia rozvytku ekonomiky [Determination of physical and chemical quality indicators of herring preserves presented on the market of poltava region]. ***Editorial Board***, [in Ukrainian].

2. Statkevych, O. I., Kolomiiets, Y. V., Holembovska, N. V., Israelian, V. M., BabychO. A., Slobodyanyuk, N. M., Babytskiy, A. I., & Statkevych, A. O. (2024) Effects of nutrient medium on various-age larvae of Hermetia illucens (Diptera, Stratiomyidae*). Regulatory Mechanisms in Biosystems*, №15(4), (PP. 907-911). https://doi.org/10.15421/0224131

3. Ezzat, M.A., Ghazali, M.H., Roselina, K., & Zare, D. (2021). Organic acid composition and consumer acceptability of fermented fish produced from black tilapia (Oreochromis mossambicus) and Javanese carp (Puntius gonionotus) using natural and acid-assisted fermentation. *Food Research*, 5(2), (PP. 262-271). doi: 10.26656/fr.2017.5(2).583.

4. Holembovska, N., Tyshchenko, L., Slobodyanyuk, N., Israelian, V., Kryzhova, Y., Ivaniuta, A., Pylypchuk, O., Menchynska, A., Shtonda, O., & Nosevych, D. (2021). Use of aromatic root vegetables in the technology of freshwater fish preserves. *Potravinarstvo Slovak Journal of Food Sciences,* 15, (PP. 296-305). doi: 10.5219/1581.

5. Vieira, H.P., Barrros, C.N., Mendes, E.S., Maciel, M.I.S., Andrade, H.A., & Oliveira Filho, P.R.C. (2019). Development and characterization of fresh sausages made with marine catfish Sciades herzbergii (Bloch, 1794). *Acta Scientiarum. Technology*. №41(1). doi:10.4025/actascitechnol.v41i1.40299.

6. Hananiah, N., & Rahim, A.A. (2022). The application of hurdle technology in extending the shelf life and improving the quality of fermented freshwater fish (Pekasam): *A review. Malaysian Journal of Science Health & Technology,* 8(1), (PP. 44-54). doi: 10.33102/2022240.

7. Dorozhko V., Holembovska N., Slobodianiuk N., Israelian V., Stetsyuk I., Pylypchuk O., Omelian A., Rudyk Y. (2025). Enhancing fish pâté with non-traditional ingredients: maca root, broccoli, and beetroot. *Scifood. 19*(1), (PP. 192-207). https://doi.org/10.5219/scifood.24

8. Novikova, N.V., Yefimova, A.L., & Leschyk, O.A. (2023). Vyvchennia kharchovoi ta biolohichnoi tsinnosti preserviv pokrashchenoi yakosti. [Study of nutritional and biological value of preserves of improved quality]. *Taurian Scientific Herald. Series: Technical Sciences*, [in Ukrainian]. doi:10.32782/tnv-tech.2023.2.22.

9. Liu, X., Ji, L., Zhang, T., Xue, Y., & Xue, C. (2019). Effects of pre-emulsification by three food-grade emulsifiers on the properties of emulsified surimi sausage. *Journal of Food Engineering*. (PP. 30-37). doi: 10.1016/j.jfoodeng.2018.11.018.

10. Sadeghinejad, N., Sarteshnizi, R.A., Gavlighi, H.A., & Barzegar, M. (2019). Pistachio green hull extract as a natural antioxidant in beef patties: Effect on lipid and protein oxidation, color deterioration, and microbial stability during chilled storage. *Food Science and Technology*, №102, (PP 393-402). doi: 10.1016/j.lwt.2018.12.060.

10. Pobedash, M.M. Aktualni problemy rynku rybnykh konserviv Ukrainy [Current problems of the market of fish preserves of Ukraine]. *In Integrated management of water resources*. [in Ukrainian].

12. Wang, Y., Chen, Q., Li, L., Chen, S., Zhao, Y., Li, C., & Sun-Waterhouse, D. Transforming the fermented fish landscape: Microbiota enable novel, safe, flavorful, and healthy products for modern consumers. *Comprehensive Reviews in Food Science and Food Safety*, 2023. 22(5), p. 3560. doi:10.1111/1541-4337.13208.

13. Rodak, O., & Fil, M. (2016). Development of fish preserves high biological value. *Scientific Messenger LNUVMBT named after S.Z. Gzhytskyj*, 2014. №18(2), (PP. 79-82). doi:10.15421/nvlvet6815.

14. Pobedash, M.M., & Sydorenko, O.V. (2014). Ways of stabilization of the consumer properties of fish preserves based on small herring fish. *Bulletin of the Chernihiv University of Technology Series: Technical Sciences*, №2, (PP. 208-212).

15. Veloso, R.R., dos Anjos, B.W., Maciel, M.I.S., Shinohara, N.K.S., Andrade, H.A., & Oliveira Filho, P.R.C. (2019). Development and evaluation of fresh sausage type of marine catfish stored under low temperatures. *International Food Research Journal*, №26(2), (PP. 619-629).

16. Nikoo, M., Regenstein, J.M., Noori, F., & Gheshlaghi, S.P. (2021). Autolysis of rainbow trout (Oncorhynchus mykiss) by-products: Enzymatic activities, lipid and protein oxidation, and antioxidant activity of protein hydrolysates. *Food Science and Technology*, 140(1), (P. 110). doi: 10.1016/j.lwt.2020.110702.

17. You, S., Yang, S., Li, L., Zheng, B., Zhang, Y., & Zeng, H. (2022). Processing technology and quality change during storage of fish sausages with textured soy protein. Foods, 11(22), article number 3546. doi:10.3390/foods11223546.

18. Zhyva ryba. Zahalni tekhnichni umovy [Live fish. General technical conditions]. (1995). DSTU 2284:1995. Kyiv: Derzhstandart Ukraine [in Ukrainian].

19. Kukhonna sil. Zahalni tekhnichni umovy [Table salt. General technical conditions]. (1997). DSTU 3583:1997. Kyiv: Derzhstandart Ukraine [in Ukrainian].

20. Otsty z kharchovoi syrovyny. Zahalni tekhnichni umovy. Derzhavnyi komitet standartu ta metrolohii Ukrainy. [Vinegars from food raw materials. General technical conditions. State Committee for Standards and Metrology of Ukraine]. (2006). DSTU 2450:2006. Kyiv: Derzhstandart Ukraine [in Ukrainian].

21. Tkachenko, O.B., Kameneva, N.V., & Titlova, O.O. (2020). *Osnovy sensornoho analizu kharchovykh produktiv. [Basics of sensory analysis of food products]*. Odesa. [in Ukrainian].

22. Slobodianiuk N.M., Golembovska N.V., Menchynska A.A., Androshchuk O.S., Tulub D.O. *Tekhnolohiia obrobky ryby. [Technology of fish processing]*. K.: CP "Komprint". [in Ukrainian].

Н. Голембовська*, кандидат технічних наук, доцент;* ***В. Ісраелян****, кандидат технічних наук, доцент (Національний університет біоресурсів та природокористування України).* ***Зміна структурно-механічних та органолептичних характеристик м'яса прісноводних риб під впливом органічних кислот***

Анотація. *У статті досліджується вплив оцтової кислоти різної концентрацій (0,5%, 0,7%, 1,0% та 1,5%) на структурно-механічні та органолептичні характеристики м'яса прісноводної риби, а саме коропа (Cyprinus carpio). Метою дослідження було визначення оптимальних технологічних параметрів використання оцтової кислоти для покращення дозрівання та сенсорних якостей м'яса коропа у виробництві пресервів. Актуальність дослідження полягає у вирішенні проблеми обмеженої протеолітичної активності прісноводних видів риб, що не дає отримати бажаної текстури та смаку без додаткових технологічних втручань.*

Філе коропа піддавали кислотній обробці протягом 30, 60 та 90 хвилин після попереднього засолювання. Ключові показники, такі як pH, гранична напруга зсуву (ГНЗ) та сенсорні властивості (текстура, смак, аромат, колір), оцінювали за допомогою стандартизованих методів. Результати дослідження показали, що обробка 1,0% оцтовою кислотою протягом 60 хвилин дала найсприятливіші результати: м'ясо досягло м'якої, соковитої текстури, приємного аромату і кольору, а також отримало найвищі сенсорні бали. Значне зниження ГНЗ свідчило про покращення ніжності та активацію протеолітичних ферментів, тоді як значення pH постійно зміщувалося в бік кислотного діапазону, що підтверджує біохімічні зміни в м'язовій тканині.

Однак тривала обробка (90 хвилин) та вищі концентрації (1,5%) призводили до часткової денатурації, втрати ніжності та видимих змін поверхні. Оптимальні параметри обробки дозволяють ефективно дозрівати, зберігаючи при цьому якість продукту. Ці результати забезпечують наукову основу для технологічного застосування оцтової кислоти у виробництві рибних пресервів з використанням місцевих прісноводних видів риб. Запропонований підхід сприяє розробці доступних, високоякісних, функціональних рибних продуктів з покращеними харчовими та сенсорними властивостями, що відповідає цілям сталого виробництва продуктів харчування.

Ключові слова: *органічні кислоти, гранична напруга зсуву, гідробіонти, органолептичні показники, прісноводна риба.*

Отримано: 07.06.2025
Прийнято: 02.08.2025
Опубліковано: 28.11.2025