Herald of Science of S.Seifullin Kazakh Agrotechnical Research University: Veterinary Sciences. – 2023 . - №1(001). – P.27-34

UDC 637.56:637.054(574.1)
doi.org /10751452/kazatuvc.2023.1(001).1348

STUDIES OF FISH AND FISH PRODUCTS FOR THE PRESENCE OF HEAVY METAL SALT AND RADIONUCLIDES IN WATER BODIES OF THE WEST KAZAKHSTAN REGION

Nurgaliyev Birzhan Elubaevich[1]
Candidate of Veterinary Sciences,nurgaliev.79@mail.ru

Zhumabayev Askhat Konysbaevich[1]
Master of Veterinary Sciences, as9982998@mail.ru

Kushmukhanov Zhenis Serikovich[1]
Master of Veterinary Sciences, jenis.90@mail.ru

Kadralieva Bakytkanym Talapovna[1]
Master of Veterinary Sciences, bkadralieva@mail.ru

Ussenov Zhangeldi Tarikhovich[1]
Master of Veterinary Sciences, usenov79@mail.ru

Inirbayev Asylkhan Kabiyevich[2]
Candidate of Veterinary Sciences,syl074@mail.ru

[1]*NJSC «West Kazakhstan Agrarian and Technical University Zhangir Khan», Uralsk, Kazakhstan*
[2]*S.Seifullin Kazakh Agrotechnical Research University, Astana, Kazakhstan*

Abstract

With the increase in production and processing industries, as well as the extraction of minerals in the territory of the Republic of Kazakhstan, it leads to pollution of the environment, ecology, wildlife and water resources of our country. All production capacities in agriculture and animal husbandry require water resources.

As part of the research work, diagnostics were carried out on the content of salts of heavy metals and radioactive substances in the water bodies of the West Kazakhstan region, where they originate with transboundary rivers and an oil and gas field (KPO) is being produced. To carry out our research work, samples of fish products were taken from 15 reservoirs and 3 objects of domestic trade for laboratory testing for the content of salts of heavy metals (Pb, Cd) and radionuclides (Sr-90, Cs-134). Radioactive substances accumulate in the bones and muscles of fish, and subsequently enter the human body through ingestion. The risk of developing adverse effects on human health depends on the radiation dose. If the radiation dose is low, or if exposure occurs over a long period of time, the risk is much lower as the human body repairs damaged cells and molecules. Lead and cadmium harm the human nervous system and its mental development, it can cause kidney damage and lead to bone disease. It is necessary to constantly monitor the content of salts of heavy metals and radionuclides in fish and livestock products, since safe products are a guarantee of public health.

Key words: Heavy metal salts;radionuclides; fish products; reservoirs; WKR.

Basic position and Introduction

In the last century, as a result of technological progress, the balance of heavy metals in the environment was disturbed, and there was a global pollution of nature with heavy metals. The most common are mercury, lead, cadmium, arsenic, copper and others. As a result, they interact with the plants and fauna of water bodies with the effluents of industrial plants entering water bodies. As a result of such interactions, heavy metals can accumulate in aquatic organisms, leading to death or disruption of life, and through trophic chains, including humans, can lead to various diseases [1].

The study of the elemental composition of aquatic organisms allows us to solve a number of ecological, physiological, veterinary and practical problems. This factor is responsible for the appearance of a significant number of works on the content of trace elements of heavy metals in commercial aquatic organisms in the last decade. Fish are capable of accumulating heavy metals in the aquatic ecosystem, even if their amount does not exceed the established limit. Pathological changes at the molecular, organism, and population levels can occur under the influence of toxic substances in fish. Since fish is a staple food, human health is at great risk [2].

Environmental pollution is a very pressing issue. The Republic of Kazakhstan is one of the states where many petrochemical complexes, ore deposits contribute to pollution of salts of heavy metals and radionuclides into the environment. Due to the increase in production capacity, urbanization of the population and the development of agriculture and fisheries, the study of water resources is an important issue. During the study of the dynamics of

toxicological and radiological contamination of fish muscle tissue (predators and benthophages) from fish farms and commercial water bodies of West Kazakhstan region. Food fish products must be made from aquatic biological resources extracted (caught) from safe areas of extraction (catching) in accordance with the data of planned monitoring of safety of aquatic biological resources, carried out by the authorized bodies of the member states, and aquaculture objects, originating from farms (enterprises) that are safe in veterinary respect.

The aquatic environment contaminated with heavy metals has a negative impact on hydrobionts, leads to an increase in ecological consequences and poses a threat not only to living organisms living in water, but also to human health. In the summer season on the background of high functional activity of the digestive system, the sensitivity of fish carbohydrases to the action of heavy metals increases [11]. The relevance of this approach is confirmed by the works carried out by scientific teams in many countries of the world [3].

For an objective assessment of the industrial impact on the pollution of hydrobionts with toxicants, it is necessary to consider the ionic-salt composition of the water of the water body under study. With increasing salinity, hardness, alkalinity of water toxicity of metals decreases, which increases the tolerance and resistance of aquatic organisms to high concentrations of metals [4].

The presence of significant fluctuations in hydrochemical indicators (salinity, hardness, alkalinity) leads to a variety of correlation relationships between biotic and abiotic factors. A certain dependence in the accumulation capacity of fish on the type of food in the Zhaik-Caspian basin in terms of lead accumulation is dominated by predators, to a greater extent catfish - 33 %, to a lesser extent pikeperch - 27 %. Lead in the muscles of benthophages is contained in similar concentrations, amounting to 20% [5,6].

Materials and methods

On contamination of fish with salts of heavy metals and radionuclides in the reservoirs Derkul, Solyanka, Embulatovka, Chizha, Barbastau hollow. Muratsay, Berezovka, Chagan, Bagyrlay, Ashysay, Shyngyrlau, Shiderti, Kaldygayly on Aydyn Island and Livkino fish nursery.

Figure 1 - Sampling Process for Laboratory Research

Sampling was carried out at the facilities of the domestic trade markets Ayazhan, El-Yrysy and Mirlan in the city of Uralsk. Processing of macrozoobenthos samples were carried out according to the standard methodological manual [6].

Toxicological and radiological studies were conducted in accordance with GOST 17319-2019 in the branch of RGP on PCV Republican Veterinary Laboratory of West Kazakhstan region. A total of 84 fish samples were examined, such as crucian carp, perch, roach, bream, ide, rudd, silver bream, podust, pike, tench, carp, zander.

Micronutrients (Lead and Cadmium) in fish muscle were determined on an atomic absorption spectrometer according to the methodological guidelines [7].

Statistical processing of data to identify the main trends and biotic parameters was carried out using Excel and Statistica [8].

Maximum permissible levels (MPL) of toxicants in fish were evaluated according to current sanitary standards [9].

Results

Residual amounts of salts of heavy metals were studied on fish samples from 15 West Kazakhstan Region reservoirs. The results of the studies are given in Figures 2 and 3. Note: the number of fish is given in parentheses.

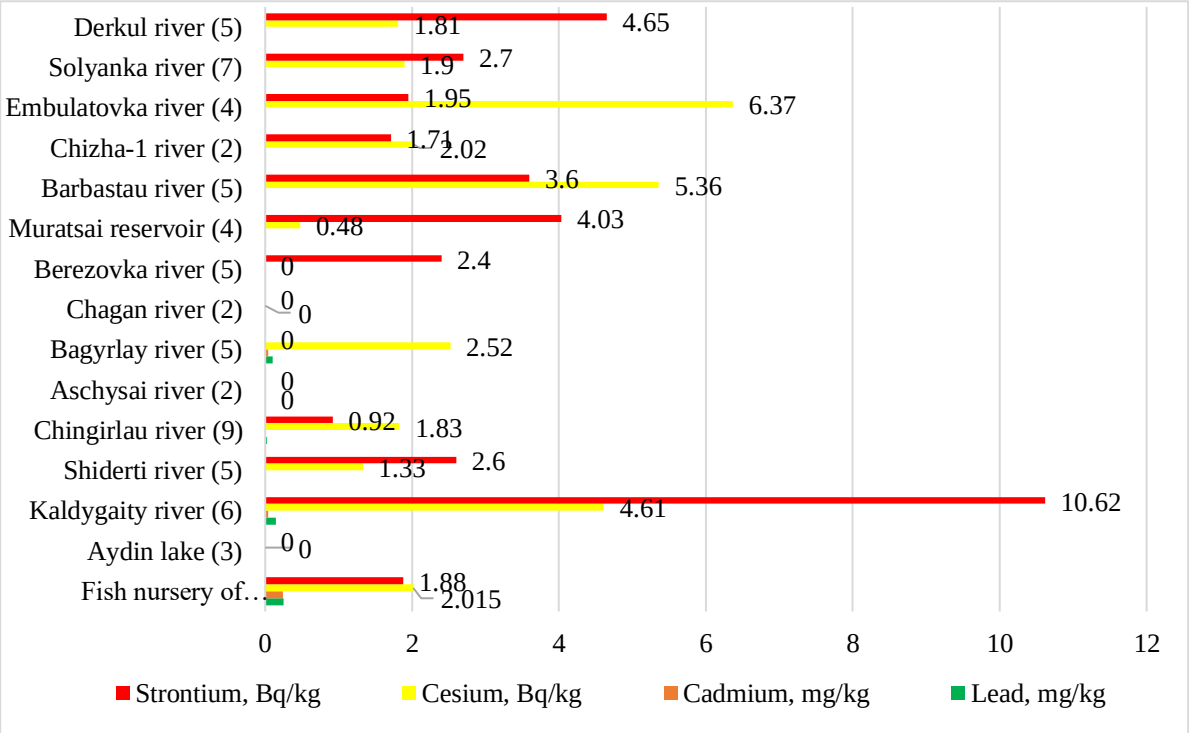

Figure 2 - Content of toxic elements and radionuclides in fish from WKR reservoirs

It follows from Figure 2 that heavy metals lead and cadmium in muscle samples of fish living in the fish nursery of «Livkino» LLP contained 0.25 mg/kg and 0.245 mg/kg Hg, Cd, Cu and Zn are considered the most dangerous in ecotoxicological respect elements [13] Kaldygaityriver - 0.148 mg/kg and 0.04 mg/kg; Shyngyrlau river - 0.02 mg/kg and 0.002 mg/kg; Bagyrlay river - 0.1 mg/kg and 0.0375 mg/kg respectively. In invertebrate animals, the TM ions can also come by dermal absorption [12].

The content of caesium 137 and strontium 90 radionuclides in fish from the fish nursery of «Livkino» LLP was within 2.015 (±14.0) Bq/kg and 1.88 (±14.85) Bq/kg; Kaldygaiti river - 4.61 (±8.31) Bq/kg and 10.62 (±29.11) Bq/kg; Shiderti river -1.33 (±5.9) Bq/kg and 2.6 (±11.83) Bq/kg; Shyngyrlau river - 1.83 (±6.7) Bq/kg and 0.92 (±11.56) Bq/kg; Dv. Muratsay - 0.48 (±2.0) Bq/kg and 4.03 (±18.42) Bq/kg; Barbastau river - 5.36 (±8.86) Bq/kg and 3.6 (±15.2) Bq/kg; Chizha river - 2.02 (±15.2) Bq/kg; Shingirlau river - 1.83 (±6.7) Bq/kg and 0.92 (±11.56 Bq/kg). Chizha-1 - 2.02 (±9.57) Bq/kg and 1.71(±15.85) Bq/kg; Embulatovkariver - 6.37 (±15.6) Bq/kg and 1.95 (±35.8); Solyankariver - 1.9 (±6.42) Bq/kg and 2.7(±19.15) Bq/kg; Derkulriver 1.81 (±5.7) Bq/kg and 4.65 (±17.61) Bq/kg, respectively[19,20]. Cesium 137 and strontium 90 were detected - only in the inhabitants of Bagyrlayriver (2,52 (±9,17) Bq/kg) and Berezovkariver (2,4 (±7,8) Bq/kg). Thus, in WKO average degree of contamination of fish and fish products with residual amounts of radionuclides does not exceed MAC (caesium 137 - 2,48 Bq/kg; strontium 90 - 3,08 Bq/kg). In all sample's heavy metals, namely arsenic and mercury, were not detected.

Lead belongs to hazard class I, its peculiarities of stay and migration in natural waters are explained by the fact that it reacts relatively easily with water impurities to form less soluble compounds. Its concentration in water is low and does not exceed 10 µg/L aquatic plants can also retain lead well. Lead accumulates insignificantly in organs and tissues, so it is relatively harmless for humans in this link of the trophic chain. According to many Russian scientists, methylated lead compounds in fish of unpolluted water bodies are relatively rare. In regions with industrial emissions, the accumulation of tetramethyl lead in fish tissues is efficient and rapid, so acute and chronic exposure to lead occurs at pollution levels of 0.1-0.5 µg/L. Hydrobionts are capable of accumulating TM to concentrations tens and even thousands of times greater than their content in the environment [14,15,16].

Cadmium is one of the toxic heavy metals; it is less toxic to plants than mercury. It is dangerous to living

organisms because it can replace zinc in enzymes with metals in their active centers, which leads to drastic disruption of enzymatic processes. This metal accumulates in the tissues of the internal organs of aquatic plants and fish [17,18].

The acute cadmium toxicity limit for freshwater fish ranges from 0.09 to 105 µg/L. Note: The number of fish is given in parentheses.

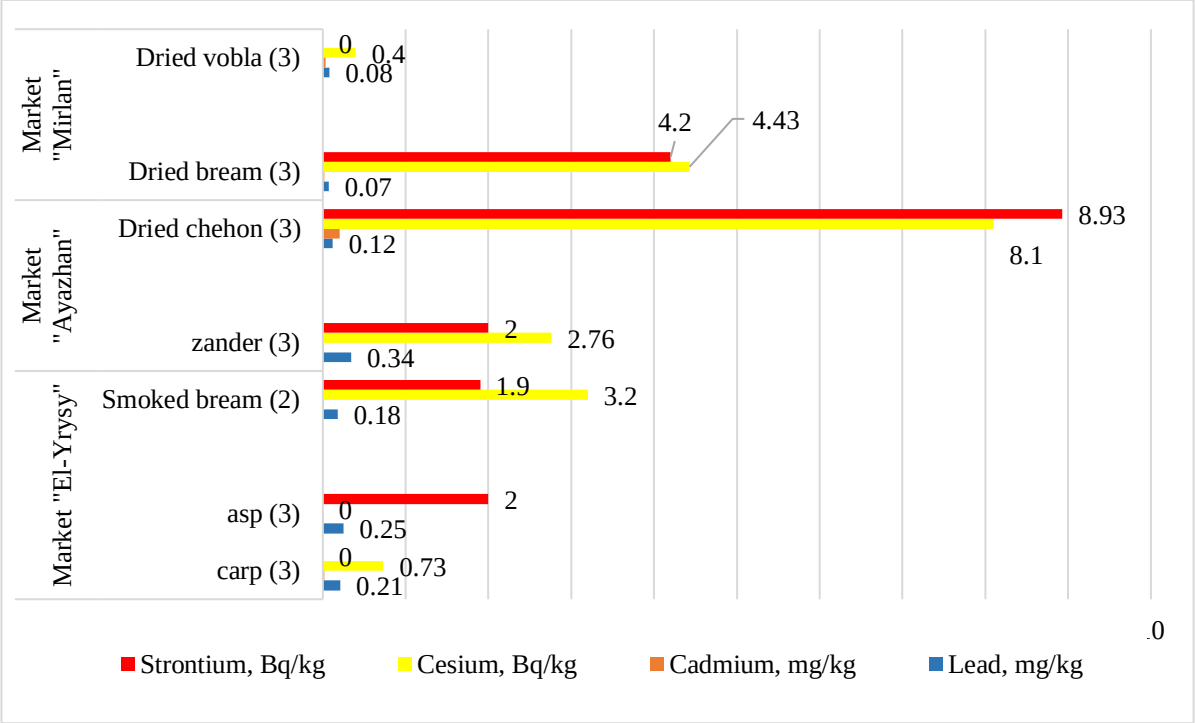

Figure 3 - Content of toxic elements and radionuclides in fish and fish products from retail outlets

The data of Fig. 3 indicate that the content of heavy metals and radionuclides in the examined samples of fish and fish products does not exceed the MPC. Thus, according to GOST 32161-2013 "Food products. Method for Determination of Cesium Cs-137" and GOST 32163-2013 "Food products. Method for Determination of Strontium Sr-90" cesium 137 and strontium 90 must not exceed 130.00 Bq/kg. and 100.00 Bq/kg, respectively.

Discussion

The monitoring of heavy metal contamination is one of the main tasks in ensuring the safety of food of animal origin. Heavy metals such as Pb, Cd and Hg, and the radionuclides Sr and Cs are toxic elements with the highest accumulation factor, but whose presence in food is strongly influenced by

environmental conditions. Exposure to metallic pollutants is particularly important in the consumption of fish, whose integration into the habitat and the biomagnification process may pose a health risk to the consumer. In the present study, it was found that the limiting value set for Sr was in the studied river Kaldagaiti (>10.62bq/kg) Derkul (>4.65bq/kg) and Cs in water samples Barbastau and Embulatovka (>6.37bq/kg,>5.36bq/kg). Cd and Pb concentrations in all analysed samples were within the permissible limits (0.148-0.2mg/kg) in Bagirlay, Shyngirlau rivers, however, it should be noted that in case of Cd and its compounds, the quality standards depend on water hardness[19].

However, it should be noted that the maximum allowable concentrations (MAC) of Pb, Cd and Hg were not exceeded in any of the rivers studied. The Pb and Cd content in the water samples from these surveyed lakes was in line with the results of the survey, as shown by the review of available sources. Analysis of bottom sediments showed a significant quantitative differentiation of the investigated metals between the individual water bodies and a significantly higher content of metals in sediments compared to concentrations in water. The results of this study are in agreement with observations by other authors that heavy metal pollutants entering surface waters are predominantly deposited in bottom sediments. This mechanism is influenced by the structure of the sediment, which, unlike the water column, is stable and immobile, preventing rapid resuspension and biochemical dissolution of metal bonds back into the water column.

Assessment of the degree of contamination of bottom sediments with heavy metals on the basis of geochemical criteria according to Boyakovskaya classification allows to refer sediments to class I, which includes sediments considered to be uncontaminated. It should be noted that the content of all investigated metals in bottom sediments of this lake did not exceed the geochemical background determined for Pb, Cd and Hg. showed that the content of heavy metals in fish tissues largely depends on the balance between absorption rate and elimination rate. And it depends on environmental conditions and the duration of life of fish. In young fish, characterized by higher metabolic activity and food intake rate, metal impurities can accumulate in tissues and organs to a greater extent than in older fish. Fish as a food product must comply with the requirements established in the legislation On the Technical Regulation of the Eurasian Economic Union On the Safety of Fish and Fish Products for Foodstuffs, i.e. the permissible content of Pb, Cd and Hg. Comparison of Pb, Cd and Hg content in the muscles of the studied fish species with the content of these metals in the muscles of different commercial fish species showed that the content of the mentioned metals in the muscles of the three studied fish species was low. Health risk assessment associated with the content of Hg, Pb,

and radionuclides Sr and Cs in the muscles of the three studied fish species sampled from the rivers was conducted in the laboratory "Republican Veterinary Laboratory" of the Committee for Veterinary Control and Supervision of the Ministry of Agriculture of the Republic of Kazakhstan and the test report results give us the results of the study. That in all investigated fish the investigated heavy metals, i.e. Pb, Cd and radionuclides Sr,Cs , did not pose a threat to the health of consumers consuming such fish species[20].

Conclusion

Summarizing the data obtained, we can state that the content of heavy metals and radionuclides in some specimens of fish and fish products WKR exceeds MPC (GOST 31903-2012), which is a consequence of industrial waste entering the water bodies.

Fish tissues can accumulate toxic substances, since they are the main species of hydrobionts and act as one of the last links in the food chain.

The contents of heavy metals (lead, cadmium, arsenic, and mercury) and radionuclides (cesium 137 and strontium 90) in fish and fish products consumed by WKR residents were within acceptable limits.

Information on financing

The work was conducted within the research project under the program BR10764944: "Development of methods of analytical control and monitoring of food safety" for the years 2021-2023.

References

1 Amirgaliev N.A. Gidrohimija, problemy vodnoj toksikologii [Text]/ N.A. Amirgaliev // Bastau, 2007 – S. 223-227.

2 Amirgaliev N.A. Ihtiofauna i jekologija Alakol'skoj sistemy ozer [Text]/ N.A. Amirgaliev, S.R. Timirhanov, Sh.A. Al'pejsov // Bastau, -2006. – S. 367-372.

3 Brovko A.V. Ispol'zovanie atomno-absorbcionnoj spektrometrii dlja opredelenija koncentracii tjazhelyh metallov v obektah okruzhajushhej sredy, pishhevyh produktah i prodovol'stvennom syr'e[Text]/ A.V. Brovko, O.V.Tihomirova, E.P.Goncharuk // Zdorov'e. Medicinskaja jekologija. Nauka. -2016. -№3 (66). – S. 171-174.

4 Golovanova I.L. Vlijanie razlichnyh faktorov na ustojchivost' pishhevaritel'nyh karbogidraz ryb k dejstviju kadmija [Text]/ I.L. Golovanova // Biologija vnutrennih vod. -2004. -№2. -P.76-83.

5 Gremjachih V.A. Nakoplenie rtuti i ee teratogennoe dejstvie na lichinok Chironumus riparius Meigen (Diptera: Chironomidae) [Text]/ V.A. Gremjachih, L.P. Grebenjuk, V.T. Komov, I.K. Stepanova // Biologija vnutrennih vod. - 2006. -№ l. – S. 99-107.

6 Kozhahmetova A.N. Bioindikacionnoe issledovanie akkumuljacii nefteproizvodnyh, tjazhelyh metallov v organizmah gidrobiontov kazahstanskoj zony Kaspija [Text]/ A.N. Kozhahmetova, A.B. Bigaliev, A.K. Shahmetov // Fundamental'nye issledovanija. -2015. -№ 2. – S. 58-62.

7 Lopareva T.Ja. Uroven' nakoplenija toksikantov v myshechnoj tkani ryb v vodnyh bassejnah Respubliki Kazahstan[Text]/ T.Ja. Lopareva, O.A. Sharipova, L.V. Petrushenko // Astrahan': Vestnik AGTU serija Rybnoe hozjajstvo. -2016. -№2. – S. 115-121.

8 Makarova N.V. Statistika v Excel [Text]/ N.V. Makarova, V. Ja. Trofimec // Finansy i statistika. 2002. – S. 368.

9 Sharapova L.I. Metodicheskoe posobie pri gidrobiologicheskih rybohozjajstvennyh issledovanijah vodoemov Kazahstana (plankton, zoobentos) [Text]: L.I. Sharapova, A.P. Falomeeva // Almaty, 2006. – 27 s.

10 Conficoni D. A limited survey of heavy metal concentrations in fresh and frozen cuttlefish ink and mantle used as food [Text]/ Daniele Conficoni, Leonardo Alberghini, Elisa Bissacco, Barbara Contiero, Valerio Giaccone // Journal of Food Protection. -2018. -№81.– P.290-294.

11 Fang Jiehong. Occurrence of virulence factors and antibiotic and heavy metal resistance in vibrio parahaemolyticus isolated from pacific mackerel at markets in Zhejiang, China [Text]/ Jiehong Fang, Hui Cheng, Ting Yu, Han Jiang // Journal of Food Protection. .2020. -№83. - P.1411-1419.

12 Guardiola F. Evaluation of waterborne exposure to heavy metals in innate immune defences present on skin mucus of gilthead seabream (Sparus aurata) [Text]/ Francisco Guardiola, Maria Dioguardi, Maria Giovanna Parisi, Maria Rosa Trapani, José Meseguer, Alberto Cuesta, Matteo Cammarata, María A. Esteban // Fish & Shellfish Immunology. -2015. -№45.– P. 112-123.

13 Jong Soo Mok. Sontents and risk assessment of heavy metals in marine invertebrates from korean coastal fish markets [Text]/ Jong Soo Mok, Ji Young Kwon, Kwang Tae Son, Woo Seok Choi, Sung Rim Kang, Na Young Ha, Mi Ra Jo, Ji Hoe Kim // Journal of Food Protection. -2014.-№77.– P.1022-1030.

14 Md Shahjahan. Effects of heavy metals on fish physiology[Text]/ Md Shahjahan, Khanam Taslima, Mohammad Shadiqur Rahman, Md Al-Emran, Shanon Iffat Alam, Caterina Faggio // Chemosphere. -2022.-№300. -P.134-141.

15 Morcillo P. In vitro immunotoxicological effects of heavy metals on European sea bass (Dicentrarchus labrax L.) head-kidney leucocytes[Text]/ Patricia Morcillo, Héctor Cordero, José Meseguer, M. Ángeles Esteban, Alberto Cuesta // Fish & Shellfish Immunology. -2015. -№47.– P.245-254.

16 Pakingking R. Microbiological Quality and Heavy Metal Concentrations in Slipper Oyster (Crassostrea iredalei) Cultured in Major Growing Areas in Capiz Province, Western Visayas, Philippines: Compliance with International Shellfish Safety

and Sanitation Standards [Text]/ Rolando Pakingking, Lilibeth Hualde, Ernestina Peralta, Joseph Faisan, Roselyn Usero // Journal of Food Protection. -2022. -№85.– P.13-21.

17 Samuel J. Cobbina. Toxicity assessment due to sub-chronic exposure to individual and mixtures of four toxic heavy metals[Text]/ Samuel J. Cobbina, Yao Chen, Zhaoxiang Zhou, Xueshan Wu, Ting Zhao, Zhen Zhang, Weiwei Feng, Wei Wang, Qian Li, Xiangyang Wu, Liuqing Yang // Journal of Hazardous Materials. -2015. -№294.– P. 109-120.

18 Sivakumar R. Effects of exposure to multiple heavy metals on biochemical and histopathological alterations in common carp, Cyprinus carpio L. [Text]/ Sivakumar Rajeshkumar, Yang Liu, Junguo Ma, Hong Ying Duan, Xiaoyu Li // Fish & Shellfish Immunology. – 2017. -№70. – P. 461-472.

19 Vergolyas M. R. Goncharuk V.V. An assessment of quality control of water by means of test organisms and their cages [Text]/ Chemistry and technology of water. -2016. - №1.– P.38-45.

20 Yin Jian. Time-response characteristic and potential biomarker identification of heavy metal induced toxicity in zebrafish [Text]/ Jian Yin, Ai-Ping Wang, Wan-Fang Li, Rui Shi, Hong-Tao Jin, Jin-Feng Wei // Fish & Shellfish Immunology. -2018. -№72. – P.309-317.

References

1 Amirgaliev N.A. (2007) Gidrohimija, problemy vodnoj toksikologii. Bastau, 223-227

2 N.A. Amirgaliev, S.R. Timirhanov, Sh.A. Al'pejsov (2006) Ihtiofauna i jekologija Alakol'skoj sistemy ozer . Bastau, 367-372

3 A.V. Brovko, O.V.Tihomirova, E.P.Goncharuk (2016) Ispol'zovanie atomno-absorbcionnoj spektrometrii dlja opredelenija koncentracii tjazhelyh metallov v obektah okruzhajushhej sredy, pishhevyh produktah i prodovol'stvennom syr'e. Zdorov'e. Medicinskaja jekologija. Nauka. 3 (66),171-174

4 Golovanova I.L. (2004) Vlijanie razlichnyh faktorov na ustojchivost' pishhevaritel'nyh karbogidraz ryb k dejstviju kadmija. Biologija vnutrennih vod. 2,76-83

5 V.A. Gremjachih, L.P. Grebenjuk, V.T. Komov, I.K. Stepanova (2006) Nakoplenie rtuti i ee teratogennoe dejstvie na lichinok Chironumus riparius Meigen (Diptera: Chironomidae. Biologija vnutrennih vod. l:99-107

6 A.N. Kozhahmetova, A.B. Bigaliev, A.K. Shahmetov (2015) Bioindikacionnoe issledovanie akkumuljacii nefteproizvodnyh, tjazhelyh metallov v organizmah gidrobiontov kazahstanskoj zony Kaspija. Fundamental'nye issledovanija. 2,58-62

7 T.Ja. Lopareva, O.A. Sharipova, L.V. Petrushenko (2016) Uroven' nakoplenija toksikantov v myshechnoj tkani ryb v vodnyh bassejnah Respubliki Kazahstan. Astrahan': Vestnik AGTU serija Rybnoe hozjajstvo. 2,115-121

8 N.V. Makarova, V. Ja. Trofimec. (2002) Statistika v Excel. Finansy i statistika. 368

9 L.I. Sharapova, A.P. Falomeeva (2006) Metodicheskoe posobie pri gidrobiologicheskih rybohozjajstvennyh issledovanijah vodoemov Kazahstana (plankton, zoobentos. Almaty, 27

10 Daniele Conficoni, Leonardo Alberghini, Elisa Bissacco, Barbara Contiero, Valerio Giaccone (2018) A limited survey of heavy metal concentrations in fresh and frozen cuttlefish ink and mantle used as food. Journal of Food Protection. 81, 290-294

11 Jiehong Fang, Hui Cheng, Ting Yu, Han Jiang (2020) Occurrence of virulence factors and antibiotic and heavy metal resistance in vibrio parahaemolyticus isolated from pacific mackerel at markets in Zhejiang, China. Journal of Food Protection. 83, 1411-1419

12 Francisco Guardiola, Maria Dioguardi, Maria Giovanna Parisi, Maria Rosa Trapani, José Meseguer, Alberto Cuesta, Matteo Cammarata, María A. Esteban (2015) Evaluation of waterborne exposure to heavy metals in innate immune defences present on skin mucus of gilthead seabream (Sparus aurata). Fish & Shellfish Immunology. 45, 112-123

13 Jong Soo Mok, Ji Young Kwon, Kwang Tae Son, Woo Seok Choi, Sung Rim Kang, Na Young Ha, Mi Ra Jo, Ji Hoe Kim (2014) Sontents and risk assessment of heavy metals in marine invertebrates from korean coastal fish markets. Journal of Food Protection. 77,1022-1030

14 Md Shahjahan, Khanam Taslima, Mohammad Shadiqur Rahman, Md Al-Emran, Shanon Iffat Alam, Caterina Faggio (2022) Effects of heavy metals on fish physiology. Chemosphere. 300, 134-141

15 Patricia Morcillo, Héctor Cordero, José Meseguer, M. Ángeles Esteban, Alberto Cuesta (2015) In vitro immunotoxicological effects of heavy metals on European sea bass (Dicentrarchus labrax L.) head-kidney leucocytes. Fish & Shellfish Immunology. 47,245-254

16 Rolando Pakingking, Lilibeth Hualde, Ernestina Peralta, Joseph Faisan, Roselyn Usero (2022) Microbiological Quality and Heavy Metal Concentrations in Slipper Oyster (Crassostrea iredalei) Cultured in Major Growing Areas in Capiz Province, Western Visayas, Philippines: Compliance with International Shellfish Safety and Sanitation Standards. Journal of Food Protection. 85, 13-21

17 Samuel J. Cobbina, Yao Chen, Zhaoxiang Zhou, Xueshan Wu, Ting Zhao, Zhen Zhang, Weiwei Feng, Wei Wang, Qian Li, Xiangyang Wu, Liuqing Yang (2015) Samuel J. Cobbina. Toxicity assessment due to sub-chronic exposure to individual and mixtures of four toxic heavy metals. Journal of Hazardous Materials. 294,109-120

18 Sivakumar Rajeshkumar, Yang Liu, Junguo Ma, Hong Ying Duan, Xiaoyu Li (2017) Effects of exposure to multiple heavy metals on biochemical and histopathological alterations in common carp, Cyprinus carpio L. Fish & Shellfish Immunology. 70, 461-472

19 Vergolyas M. R. Goncharuk V.V. (2016) An assessment of quality control of water by means of test organisms and their cages. Chemistry and technology of water. 1, 38-45

20 Jian Yin, Ai-Ping Wang, Wan-Fang Li, Rui Shi, Hong-Tao Jin, Jin-Feng Wei (2018) Time-response characteristic and potential biomarker identification of heavy metal induced toxicity in zebrafish. Fish & Shellfish Immunology. 72, 309-317

Түйін

Өндіріс пен өңдеу өнеркәсібінің ұлғаюымен, сондай-ақ Қазақстан Республикасының аумағында пайдалы қазбалардың өндірілуімен еліміздің қоршаған ортасының, экологиясының, жануарлар дүниесі мен су ресурстарының ластануына әкеліп соғады. Ауыл шаруашылығы мен мал шаруашылығындағы барлық өндірістік қуаттар су ресурстарын қажет етеді. Ғылыми-зерттеу жұмыстарының шеңберінде Батыс Қазақстан облысының трансшекаралық өзендерден бастау алатын және мұнай-газ кен орны (ҚПО) өндірілетін су айдындарындағы ауыр металдар мен радиоактивті заттардың тұздарының құрамы бойынша диагностика жүргізілді. Зерттеу жұмысымызды жүзеге асыру үшін ауыр металдар (Pb, Cd) тұздарының және радионуклидтердің (Sr-90, Cs-134) құрамын зертханалық тексеру үшін 15 су қоймасы мен 3 ішкі сауда объектілерінен балық өнімдерінің сынамалары алынды. Радиоактивті заттар балықтардың сүйектері мен бұлшықеттерінде жиналып, кейіннен адам ағзасына жұту арқылы түседі. Адам денсаулығына жағымсыз әсер ету қаупі сәулелену дозасына байланысты. Егер сәулелену дозасы төмен болса немесе әсер ету ұзақ уақыт бойы болса, адам ағзасы зақымдалған жасушалар мен молекулаларды қалпына келтіретіндіктен, қауіп әлдеқайда аз болады. Қорғасын мен кадмий адамның жүйке жүйесіне және оның психикалық дамуына зиянын тигізеді, ол бүйректі зақымдап, сүйек ауруына әкеледі. Қауіпсіз өнімдер халық денсаулығының кепілі болғандықтан, балық пен мал шаруашылығы өнімдерінде ауыр металдар мен радионуклидтердің тұздарының мөлшерін үнемі бақылау қажет.

Кілт сөздер: ауыр металл тұздары; радионуклидтер; балық өнімдері; су қоймалары; БҚО.

Аннотация

С увеличением производственных и перерабатывающих производств, а также добыча полезных ископаемых на территории Республики Казахстан приводит к

загрязнению окружающей среды экологии, животного мира и водных ресурсов нашей страны. Во всех производственных мощностях в сельском хозяйстве и животноводстве необходимо водные ресурсы. В рамках научно-исследовательской работы проведена диагностика по содержанию солей тяжелых металлов и радиоактивных веществ в водоемах Западно-Казахстанской области, где они берут начало с трансграничными реками и ведется добыча нефтегазового месторождения (КРО). Для выполнения научно-исследовательской работы были отобраны пробы рыб и рыбной продукции из 15 водоемов и 3-х объектах внутренней торговли для лабораторного исследования на содержание солей тяжелых металлов (Pb,Cd) и радионуклидов (Sr-90,Cs-134). Радиоактивные вещества накапливаются в костях и мышцах рыб, и последовательно попадают в организм человека при употреблении в пищу.Риск развития неблагоприятных последствий для здоровья человека зависит от дозы облучения. Если доза облучения низкая или если облучение имеет место в течение длительного периода времени, риск значительно ниже, поскольку организм человека восстанавливает поврежденные клетки и молекулы.Свинец и кадмии наносит вред нервной системе человека и его умственному развитию может вызвать нарушение работы почек и привести к болезням костей. Необходим постоянный контроль над содержаниям солей тяжелых металлов и радионуклидов в продукции рыбоводства, так как безопасная продукция залог здоровья населения.

Ключевые слова:соли тяжелых металлов;радионуклиды; рыбная продукция; водоемы; ЗКО.