UDC 614.31:597

MINERAL CONTENT OF FISH MEAT IN THE APPLICATION OF NFA TSEOFISH

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The article presents the results of a study of the mineral composition of fish meat when used in feed Tseofish feed additive. Tseofish non-traditional feed additive is made from natural mineral - zeolite of Chankanay deposits. The experimental part of the work carried out at the Department of "Veterinary and sanitary examination and hygiene" of the Kazakh National Agrarian University and in the laboratory called "Nutritest" of the Kazakh Scientific Research Academy of Nutrition. The objects of study were the meat of rainbow trout and sterlet (m = 40). To study the mineral composition of fish meat in their diet was added 1,2,3,4% of the feed additive Tseofish. The study results showed that the feed additive based on zeolite in a 4% increase the content of mineral elements of fish meat compared with the control group. Thus, the content of potassium in the fourth test group reached 451.8 mg / kg, and the calcium content of 37.45 mg / kg. The quantitative content of magnesium and sodium in the fourth group of rainbow trout also increased compared with the control group and were 27.15 mg / kg and 58 mg / kg, respectively. A number of micronutrients decreased in the fourth experimental group compared with the control group, probably due to selective adsorbent properties of the NFA Tseofish. On this basis, it should be concluded that the non-traditional feed additive based on natural mineral zeolite has an impact on increasing the level of macronutrients in the fish meat without causing any adverse effects.

Keywords: Tseofish, zeolite, a mineral, fish, rainbow trout, sturgeon, a control group, the experimental group, elements, meat.

ЦЕОФИШ ДАҚ КОЛДАНҒАН КЕЗДЕ БАЛЫҚ ЕТІНІҢ МИНЕРАЛДЫ ҚҰРАМЫ

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Мақалада Цеофиш дәстүрлі емес азық қоспасын қолданған кезде балық етінің минералды құрамын зерттеу нәтижелері келтірілген. Шаңқанай кен орнынан алынған Цеофиш дәстүрлі емес азық қоспасы табиғи минералдан, яғни цеолиттен жасалған. Жұмыстың тәжірибелік бөлімі Қазақ ұлттық аграрлық университетінің «Ветеринариялық-санитариялық сараптау және гигиена» кафедрасында және Қазақ ғылыми-зерттеу тағамтану академиясының «Нутритест» зертханасында орындалды. Зерттеу нысаны бахтах пен сүйіктің еті болып табылды (n=40). Балықтардың минералды құрамын зерттеу үшін балықтардың азығына 1,2,3,4% Цеофиш азық қоспасын қостық. Зерттеу нәтижелері 4% цеолит негізіндегі азықтық қоспа бақылау тобымен салыстырғанда тәжірибелік топта балық етіндегі минералды элементтердің мөлшерін жоғарылататынын көрсетті. Сонымен, төртінші тәжірибелік топта калий мөлшерінің 451,8 мг/кг жеткенін байқаймыз, ал кальций мөлшері 37,45 мг/кг құрады. Төртінші топтағы магний мен натрийдің мөлшері бақылау тобымен салыстырғанда төмендеді, бұл Цеофиш азық қоспасының адсорбциялық қасиеттеріне байланысты болуы мүмкін. Қорытындылай келе, цеолит табиғи минерал негізінде жасалған Цеофиш дәстүрлі емес азық қоспасы балықтар етіндегі макроэлементтердің мөлшерлерін жоғарылатып, теріс әсер бермейтіні туралы айта кеткен жөн.

Кілтті сөздер: Цеофиш, цеолит, минерал, балықтар, бахтах, сүйрік, бақылау тобы, тәжірибелік топ, элементтер, ет.

МИНЕРАЛЬНЫЙ СОСТАВ МЯСА РЫБЫ ПРИ ПРИМЕНЕНИИ НКД ЦЕОФИШ

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В статье приведены результаты исследования минерального состава мяса рыбы при использовании в кормах кормовой добавки Цеофиш. Нетрадиционная кормовая добавка Цеофиш сделана на основе природного минерала Чанканайского месторождения – цеолита. Экспериментальная часть работы выполнена на кафедре «Ветеринарно-санитарной экспертизы и гигиены» Казахского национального аграрного университета и в лаборатории «Нутритест» Казахской научно-исследовательской академии питания. Объектами исследования служили мяса радужной форели и стерляди (n=40). Для исследования минерального состава мяса рыбы в их корм добавляли 1,2,3,4% кормовой добавки Цеофиш. Результаты исследования показали, что кормовая добавка на основе цеолита в 4% увеличивает содержание минеральных элементов в мясе рыбы по сравнению с контрольной группой. Так, содержание калия в четвертой подопытной группе достигло 451,8 мг/кг, а содержание кальция 37,45 мг/кг. Количественное содержание магния и натрия в четвертой подконтрольной группе радужной форели также увеличилось по сравнению с контрольной группой и составило 27,15 мг/кг и 58 мг/кг соответственно. А количество микроэлементов снизилось у четвертой подопытной группы по сравнению с контрольной группы, что вероятно связано с избирательными адсорбирующими свойствами НКД Цеофиш. Исходя из этого, следует заключить что нетрадиционная кормовая добавка на основе природного минерала цеолит оказывает влияние на повышение уровня содержания макроэлементов в мясе рыбы при этом не вызывая каких-либо негативных воздействий.

Ключевые слова: Цеофиш, цеолит, минерал, рыбы, радужная форель, стерлядь, контрольная группа, опытная группа, элементы, мясо.

Zeolites are crystalline solids structures made of silicon, aluminum and oxygen that form a framework with cavities and channels inside where cations, water and/or small molecules may reside. They are often also referred to as molecular sieves. Many of them occur naturally as minerals, and are extensively mined in many parts of the world finding applications in industry and medicine. However, most of zeolites have been made synthetically some of them made for commercial use while others created by scientists to study their chemistry. At present, there are 191 unique zeolite frameworks identified [1], and over 40 naturally occurring zeolite framework are known.

Zeolites are crystalline aluminosilicates with open 3D framework structures built of SiO_4 and AlO_4 tetrahedra linked to each other by sharing all the oxygen atoms to form regular intra-crystalline cavities and channels of molecular dimensions. A defining feature of zeolites is that their frameworks are made up of 4-coordinated atoms forming tetrahedra. These tetrahedra are linked together by their corners and make a rich variety of beautiful structures. The framework structure may contain linked cages, cavities or channels, which are big enough to allow small molecules to enter. The system of large voids explains the consistent low specific density of these compounds. In zeolites used for various applications, the voids are interconnected and form long wide channels of various sizes depending on the compound. These channels allow the easy drift of the resident ions and molecules into and out of the structure. The aluminosilicate framework is negatively charged and attracts the positive cations that reside in cages to compensate negative charge of the framework. Unlike most other tectosilicates [2], zeolites have largeer cages in their structures.

The naturally occurring zeolites are an important group of minerals for industrial and other purposes. The discovery in 1957 of largedeposits of relatively high purity zeolite minerals in volcanic tuffs in the western United States and in a number of other countries represents the beginning of the commercial natural zeolite era. Prior to that time there was no recognized indication that zeolite minerals with properties useful as molecular sieve materials occurred in large deposits. Commercialization of the natural zeolites chabazite, erionite, and mordenite as molecular sieve zeolites commenced in 1962 with their introduction as new adsorbent materials with improved stability characteristics. The applications of clinoptiolite in radioactive waste recovery and in waste water treatment during the same period of the 60's were based not only on superior stability characteristics but also high cation exchange selectivity for cesium, strontium, and for ammonium ion.

The well known and industrially important zeolites have been discovered in 1950-1970 and may be classified into three groups according to Al/Si ratio in their frameworks [3].

An important group of substances belonging to the indispensable nutritional factors and influences the quality and nutritional value of meat and its products are minerals.

Minerals found in different parts of the fish body in unequal amounts. Minerals found in the ash obtained by burning the meat and other parts and organs of the fish. The greatest amount of mineral elements contained in the bones. Total amounts of minerals in the body of the fish are 4%. In fish quantitatively predominant phosphorus, calcium, potassium, sodium, magnesium, sulfur, and chlorine (macronutrients).The rest of the detected elements - iron, copper, manganese, cobalt, zinc, molybdenum, iodine, bromine, fluorine, etc.In very small amounts (micronutrients).The bulk of calcium and phosphorus in

the body of the fish found in the bones, forming their hard skeleton. Sodium, potassium, phosphorus, magnesium, chlorine included in the sarcoplasmic muscle cells, interstitial fluid, blood plasma. Sulfur is included in the composition of proteins.

Great physiological importance is the trace elements that are part of a series of important organic compounds.

In marine fish meat contains more minerals than meat fresh. An important difference between marine and freshwater fish is the almost complete absence in the meat of freshwater fish of iodine and bromine [4].

Materials and methods

The mineral composition of fish meat was assessed as follows: iron was determined by the colorimetric method using GOST26928-86; while for the determination of calcium and magnesium GOST-09-066-02 was used.

For determining mineral content the method of dry ashing was used. That istook place in anashing muffle furnace at 400-600°C. In order to accelerate the process of loosening using NH (CO) a sample was placed in a bomb chamber filled with oxygen and closed. The combustion process took three minutes. The resultant ash containing metal oxides was treated with a solution of HCl (1: 1) to obtain the soluble metal chlorides.

Research results

Results of the analysis of the mineral composition of valuable species of fish are shown in Tables 1-2.

Studies of the mineral composition of meat of rainbow trout and sturgeon have shown that it is rich with essential functionally significant components that make them biologically valuable product.

The mineral components as evidenced by the results obtained are not significantly different for the test and control samples of meat, except iron and zinc, which level is somewhat lower in the meat of rainbow trout fed NFA Tseofish. In our opinion, this may be due to high adsorption capacity of the latter.

In the study of the meat of rainbow trout and sterlet in the feed, a feed additive which adds Tseofish content of sodium and potassium was in physiological amounts, which allows maintaining the osmotic pressure of body fluids and participating in the formation of a buffer system of tissues and biological fluids. The amount of manganese in the range - 0,11-0,22 g/100 g of meat of rainbow trout in the experimental groups and 0,016-0,027 mg/kg meat sterlets increases glycogen synthesis, and increases the efficiency of absorption of vitamins C and B, which actively influences growth and development of fish.

The content of calcium and phosphorus in the experimental groups of valuable fish species also remained normal, significant changes in the direction of decreasing was observed.

Table 1 - Mineral content in the meat of rainbow trout (control and test, mg 100 g)

Indicators units of measurement	Control group (n=20)	Experimental group (n=20)				Physiological norm
		1%	2%	3%	4%	
Macronutrients mg/kg						
K	380±0,7	411,7±0,3	420±0,21	431,8±0,15	451,8±0,23	60-420
Ca	34,5±0,61	32,5±0,16	34±0,17	36,78±0,13	37,45±0,13	17-270
Mg	25±0,77	24,55±0,2	25,9±0,07	26,43±0,51	27,15±1,43	10-170
Na	54,9±0,7	57±0,19	56±0,19	57,5±0,17	58±0,41	30-130
P	209,9±0,68	208,6±0,24	205,5±0,15	213,01±0,23	215±0,121	110-550
Micronutrients mg/kg						
Fe	0,8±0,07	0,7±0,014	0,6±0,017	0,62±0,003	0,7±0,58	0,3-4,6
Zn	2,1±0,02	1,79±0,002	1,92±0,002	1,81±0,005	1,90±0,82	0,05-0,60
Mn	0,14±0,004	0,14±0,002	0,15±0,002	0,21±0,003	0,22±0,53	0,016-0,044

Table 2 - Mineral content in the meat of sturgeon (control and test, mg 100 g)

Indicators units of measurement	Control group (n=20)	Experimental group (n=20)				Physiological norm
		1%	2%	3%	4%	
Macronutrients mg / kg						
K	280±0,032	289±0,043	297±0,069	303±0,058	308±0,048	60-420
Ca	44±0,023	47±0,056	53±0,239	58±0,357	61±0,357	17-270
Mg	66±0,035	69±0,092	72±0,245	75,1±0,95	78,9±0,64	10-170
Na	92±0,02	98±0,002	103±0,42	107±0,032	111±0,56	30-130
P	259±0,34	263±0,204	268±0,394	277±0,053	283±0,102	110-550
Micronutrients ug / kg						
Fe	0,7±0,03	0,8±0,06	0,8±0,05	0,9±0,06	0,9±0,05	0,3-4,6
Zn	0,6±0,35	0,6±0,56	0,7±0,78	0,7±0,78	0,7±0,45	0,05-0,60
Mn	0,015±0,75	0,016±0,81	0,020±0,74	0,023±0,72	0,027±0,53	0,016-0,044

Conclusion

After analyzing the obtained parameters of the mineral composition of meat of valuable fish species in the feed, a feed additive which adds Tseofish we came to the conclusion that certain trends in the overall reduction of mineral substances in the meat of rainbow trout and sterlet experimental groups were noted.

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