

## ABSTRACT

**the dissertation work of Sherimova Saule Kurmanovna on the topic «Veterinary and sanitary assessment of milk and dairy products when using the feed additive «Vermikom» in the diet of cow» submitted for the degree of Doctor of Philosophy (PhD) educational program 8D09102 – «Veterinary sanitation»**

**Relevance of the research topic.** Dairy cattle breeding plays a significant role in providing the population with high-quality and cheap products. The development of this industry and its effectiveness depend on the proper use of available feed products. Feed additives, as a rule, must compensate for the missing elements in the diet. In recent years, functional feed additives have been increasingly used that meet the requirements of the animal body and are able to deliver nutrients more efficiently, increasing the biological and nutritional values of livestock products.

Additives based on natural minerals are used as feed additives of the new generation. Natural minerals are rich in biogenic macro- and microelements, replenish the mineral nutrition of farm animals, stimulate digestive processes and increase the digestibility of nutrients, as a result of which the body's natural ability to resist negative factors increases, animal productivity increases and product quality improves.

Among the natural minerals, vermiculite is the most effective replenisher of mineral nutrition in the body of animals and a sorbent of toxins. Vermiculite is an aluminosilicate, which is a product of hydrothermal decomposition of biotite, phlogopite, some chlorites and other silicates rich in magnesium. It has a relatively high moisture-retaining capacity and has a golden color, an accordion-shaped appearance. Vermiculite does not contain carcinogenic or harmful to human and animal health impurities. The presence of macro- and microelements in the composition of vermiculite in a sufficiently large amount distinguishes it from other natural minerals. When using vermiculite, the body is enriched with the necessary micro- and macronutrients, while endo- and exotoxins are excreted from the body and the digestive tract is prepared for better absorption of necessary substances. Vermiculite improves digestive processes by increasing the area of biochemical reactions in the intestine, sorption of low molecular weight metabolites.

Data on the effect of local vermiculite on veterinary and sanitary indicators, biological safety of milk and dairy products are limited in the scientific literature. In this regard, the development of feed additives based on vermiculite and the study of their effect on increasing animal productivity, improving the sanitary quality and safety of food of animal origin is of great importance.

We conducted studies on the effect of the feed additive "Vermikom" obtained on the basis of vermiculite of Kazakhstani production on the veterinary and sanitary indicators of milk and dairy products, as well as on the dairy productivity of cows and the removal of heavy metals from the body of animals.

**The purpose of the dissertation research** - the study was a veterinary and sanitary assessment of the quality of milk and dairy products when using the feed additive "Vermikom".

### **Research objectives:**

- to study the effects of vermiculite on the quality and technological properties of sunflower cake during its storage and to develop a new feed additive "Vermikom" based on local vermiculite;
- to study the hematological and biochemical blood parameters of cows that received different doses of feed additive «Vermikom» in the diet;
- to determine the effects of the feed additive «Vermikom» on the dairy productivity of cows;
- to study the veterinary and sanitary indicators of milk and dairy products of the control and experimental groups of cows;
- to study the mineral and amino acid composition of milk when using different doses of feed additive "Vermikom";
- to study the effects of feed additive «Vermikom» on the reduction of residual amounts of heavy metals in the body of cows.

### **Materials and methods of research.**

*Objects of research:* vermiculite of the Kulantau deposit, feed additive "Vermikom", animal products (milk, dairy products).

The research methods are described in GOST and regulatory documents.

The quality of samples of feed additives based on sunflower cake with vermiculite was determined in accordance with GOST 80-96 "Sunflower cake. Technical conditions". The organoleptic parameters of cakes - appearance, color, odor, presence of dark inclusions – were determined according to GOST 13979.4-68, taste - according to GOST 27558-87. Miscibility, traceability and flowability were determined visually. The total number of NMFAM was determined in accordance with GOST ISO 7218-2015. The acid number of fat was determined in accordance with GOST 13496.12-98, the amount of moisture – according to GOST 13979.1-68. Determination of crude protein by the Kjeldahl method GOST 13496.4-68. The mass fraction of crude fat is GOST 13979.2-68. All organoleptic and physico-chemical studies were carried out in threefold repetition. The study of the physico-chemical composition of milk was carried out in the laboratory of Kazakh Scientific Research Institute of Processing and Food Industry LLP. To determine the amount of fat, protein and milk density, the Lactane 600 analyzer was used (Manufacturer: Russian Farm LLC, Russia). The Ph value and titrated concentration were determined using the TitroLine 5000 titrator (SI Analytics, Germany).

Hematological examination of cow blood was performed on an automatic hematological analyzer for veterinary medicine VS-2900 VetPlus (Mindray, China), which allows to determine the number of erythrocytes, leukocytes and hemoglobin. The serum carotene content was determined by photometric method. The total protein in the blood serum was determined by the refractometric method using the ИРФ-454 В 2М refractometer (НВ-ЛабКазakhstan LLP, Almaty, Kazakhstan). The content of inorganic phosphorus was determined on a BioChemSa laboratory medical photometer device («HighTechnology, Inc.», USA). To do this, we used a set of reagents for the determination of glucose in biological fluids by the glucose oxidase method " Глюкоза-АГАТ " (АГАТ-МЕД LLC, Moscow, Russia). Determination of total calcium in blood serum was carried out by the Wilkinson

complexometric method. The alkaline reserve in blood plasma was established by the diffuse method.

The mineral composition of milk was determined using the KBAHT.Z atomic absorption spectrometer.Z («КОПТЭК» LLC, Moscow, Russia).

Quantitative analysis of amino acids in cow's milk was carried out in the laboratories of the West Kazakhstan regional branch of the Republican Veterinary Laboratory using high-performance liquid chromatography (HPLC) using an LC-10 liquid chromatograph with a fluorimetric detector and pre-column derivatization.

Work on the determination of residual amounts of heavy metals in feed and milk was performed on the novAA350 atomic absorption spectrometer (AnalytikJena, Germany) in accordance with the following regulatory documents: GOST 30178-96 Raw materials and food products. Atomic absorption method for the determination of toxic elements; - MU 08-47/162 Voltammetric method for measuring the mass concentration of mercury; - MU 31-09/04 Methodology for measuring the mass concentration of arsenic by inversion voltammetry on TA type analyzers.

**The main provisions submitted for protection:**

- The effect of local vermiculite on the storage quality of sunflower cake during its storage. Development of the feed additive «Vermikom».

- Feed additive "Vermikom" in optimal doses has a pronounced positive effect on the hematological and biochemical composition of blood and ensures high milk productivity of cows.

- Veterinary and sanitary assessment, chemical, mineral and amino acid composition of milk from cows that received different doses of feed additive "Vermikom" in the diet.

- The effect of feed additive "Vermikom" on the excretion of heavy metals from the body of cows.

**Description of the main results of the study.** Vermiculite had a positive effect on the quality of sunflower cake during storage: the total number of microorganisms in the samples and the indicator of mold fungi were stable, after six months of storage, the acidic amount of the sample with the addition of 20% vermiculite was 8.9% lower compared to the control group, the moisture content in the fourth and fifth samples averaged  $4.1 \pm 0.3\%$  and  $3.3 \pm 0.5\%$ , these indicators are 70.0% and 75.9% lower than in the control sample, the crude protein content during six months of storage in the first sample was 18.1%, in the second - 18.1%, in the third - 17.7%, in the fourth sample - 18.9%, in the fifth - 18.7%, in the sixth - 18.2%. Samples containing 20% and 30% vermiculite, according to the veterinary medical examination, had a good appearance and had good flowability.

Based on the results of the conducted experimental studies, a feed additive "Vermikom" was developed based on a local natural mineral – vermiculite. 80% of the feed additive "Vermikom" was expanded vermiculite of the M-150 brand of the Kulantau deposit and a fraction of 5-10 mm and 20% sunflower cake.

According to the study of the toxicity of the Vermikom feed mixture for laboratory mice, its LD<sub>50</sub> index was not established. That is, even when adding the maximum amount of the Vermik feed mixture to the main diet of mice of the

experimental groups, no changes or physiological abnormalities were detected in the body of mice.

According to the study of blood parameters of cows using the feed additive "Vermikom" in the amount of 4%, the average hemoglobin content in the blood was  $109.21 \pm 1.12$  g/l, which is 5.75% higher than in the control group, and the red blood cell content was 8.9% higher. Meanwhile, the number of white blood cells was 10% lower than in the control group. In general, the feed additive "Vermikom" contributed to the improvement of hematological and biochemical parameters of the blood of cows.

The average daily productivity of cows of the first experimental group to determine the milk productivity of cows was 2.65% higher than in the control group, and the average daily productivity of cows of the second experimental group was 14.2% higher.

According to the veterinary and sanitary assessment of the quality of milk and dairy products, when adding the Vermik feed additive to the diet of cows, the organoleptic parameters of milk samples in all groups met the requirements, there was no special difference in the mass fraction of fat in milk between all groups, and the average protein content in the first experimental group was 2.98%, in the second experimental group-3.02%, in the control group-2.96%.

According to the results of studies of the mineral composition of milk samples, the calcium content in the sample using the feed additive "Vermikom" in the amount of 4% was 0.9% higher than in the control group, phosphorus- 8.2%, iron – 21.4%. The same level of increase was also associated with elements such as magnesium and manganese. In general, the use of the feed additive "Vermikom" influenced the increase in the content of macro – and microelements in milk. The results obtained met the requirements of the state standard.

At the end of the experiment to determine the effect of the feed additive "Vermikom" on the residual content of heavy metals in milk in cows of the second group, i.e. in the group in which the feed additive was used in the amount of 4%, the cadmium content was 0.0074 mg/kg, and the lead concentration was 0.0025 mg/kg. The content of these elements is 8.6% and 28% lower, respectively, compared with the control group. In addition, certain concentrations of lead and cadmium in these groups did not exceed the maximum permissible concentrations. And the residual amounts of mercury and arsenic have not been determined.

**Substantiation of the novelty and importance of the results received.** For the first time, the feed additive "Vermikom" was made from the local mineral vermiculite. Comprehensive studies have been conducted to study the introduction of the feed additive "Vermikom" and its effect on the dairy productivity of cows. The veterinary and sanitary indicators of milk and dairy products have been studied. The effects of the feed additive "Vermikom" on organoleptic and microbiological parameters, as well as the chemical, mineral and amino acid composition of milk were determined. The positive effect of the feed additive "Vermikom" on the hematological and biochemical parameters of the blood of cows was revealed. The sorption effect of the feed additive "Vermikom" in the body of cows to cadmium and lead salts has been established.

**Accordance with the main directions of science development or state programs.**

The Law of the Republic of Kazakhstan "On the protection, reproduction and use of wildlife" dated July 9, 2004 No. 593.

Strategic Plan of the Ministry of Ecology, Geology and Natural Resources of the Republic of Kazakhstan for 2017-2021.

**Description of the PhD student's contribution to the preparation of each publication.** Based on the results of own research, the doctoral student prepared and published 4 scientific papers under the guidance of scientific consultants, including 1 article in a journal included in the Scopus database of companies.

- Vermikom feed additive effects on dairy cows' blood and milk parameters // Veterinary World (Scopus) - 2022, Vol.15(5)6 P.1228-1236. doi: [www.doi.org/10.14202/vetworld.2022.1228-1236](http://www.doi.org/10.14202/vetworld.2022.1228-1236).

3 articles in publications recommended by the Committee for Quality Assurance in the Field of Science and Higher Education of the Ministry of Science and Higher Education of the Republic of Kazakhstan:

- Мал шаруашылығында азықтық қоспа ретінде қолдануға арналған отандық вермикулитті ветеринариялық-санитариялық бағалау // Научный журнал: «ҒЫЛЫМ ЖӘНЕ БІЛІМ». - 2021. - №2 - 1(63). – С.124-132. DOI: <https://doi.org/10.52578/2305-9397-2021-1-2-124-132>;

- «Вермиком» азықтық қоспасын қолданған жағдайдағы сиыр сүтінің сапасын ветеринариялық-санитариялық бағалау // Научный журнал: «ҒЫЛЫМ ЖӘНЕ БІЛІМ». - 2022. - №4 - 1(69). – С.35-43. DOI: <https://doi.org/10.56339/2305-9397-2022-4-1-35-44>;

- «Вермиком» азықтық қоспасының зертханалық тышқандарға ветеринариялық-токсикологиялық қауіпсіздігін бағалау // Научный журнал: «ҒЫЛЫМ ЖӘНЕ БІЛІМ». - 2023. - №1 - 1(70). – С.11-18. DOI: <https://doi.org/10.56339/2305-9397-2023-1-1-11-18>.

**The volume and structure of the thesis.**

The thesis is presented on 153 pages of computer text and consists of an introduction, review of literature, materials and research methods, the results of their own research, conclusions, list of sources used, applications. The thesis is illustrated with 23 tables, 20 drawings. The list of references includes 302 titles