

MRNTI 87.53.18

S.T. Duisenbayeva | ©



Cand. tech. sci., acc. prof.

ORCID

<https://orcid.org/0000-0001-6054-9589>

Taraz Regional University named after M.Kh. Dulaty



Taraz, Kazakhstan



saule631105@mail.ru

<https://doi.org/10.55956/LTUM9584>

## ORGANIC FERTILIZER PRODUCTION TECHNOLOGY FROM LIVESTOCK AND POULTRY WASTE BY BIOLOGICAL FERMENTATION

**Abstract.** This article explores the technology for the production of organic fertilizers from livestock and poultry waste by biological fermentation. The purpose of the scientific work is to commercialize research and development of technologies for biological fermentation of livestock and poultry wastes. The article deals with the creation of the production of organic fertilizers using environmentally friendly technology through the processing of livestock and poultry waste, which will provide an effective solution to the problem of improving soil fertility and the development of organic farming.

**Keywords:** atmosphere, organic waste, poultry farming, animal husbandry, environmental pollution, recycling, gene pool.



Duisenbayeva S.T. Organic fertilizer production technology from livestock and poultry waste by biological fermentation // *Mechanics and Technology / Scientific journal*. – 2021. – No.2(72). – P.142-147. <https://doi.org/10.55956/LTUM9584>

**Introduction.** Man has had an impact on the environment since ancient times. As a result, many centuries of human activity have left deep traces on modern soil and vegetation, air and drinking (aquatic environment), and animal life. The Republic of Kazakhstan is not an exception in this respect [1-5].

One of the most pressing economic and environmental problems remains the management and processing of organic waste from livestock and poultry production. There is a need for a comprehensive solution.

The processing of avian manure and poultry manure (cattle) is one of the most pressing environmental issues in the world. Among them, modern poultry breeding complexes are not only producers of poultry meat and eggs, but also of waste, much more so than the main product.

Industrial livestock and poultry wastes are highly polluting, as the litter is a major source of pollution (soil, flora and fauna, groundwater) and has a negative impact on the health of the population. And in this case, the manure in many chicken farms is stored in manure stores for years without being recycled.

At present, with the development of poultry factories and livestock breeding complexes, the question of the processing of waste resulting from the activity of a living organism has become urgent. Almost all enterprises built after 2000 try to

apply only the latest technologies and modern equipment for animal housing. But this is not the case with manure processing. Currently, there are practically no farms in the territory of the Republic of Kazakhstan where waste treatment plants or technologies are used. Many countries have nationwide and regional programs to reduce the negative environmental impact of these wastes [5-9].

By comparison, one can cite the case of Europe, where a law has been in force for about 10 years prohibiting the dumping of untreated organic waste in fields. Also in the West, because of the danger of intrusion of aggressive components of manure into the soil, deep-sea storage of waste is strictly prohibited and is used everywhere in Kazakhstan.

Agriculture contributes to pollution by polluting fields and land with various agricultural wastes: bird droppings, manure and garbage. This amounts to hundreds of millions of tons of waste. Most of the waste is incinerated by people and enterprises [1-5].

The relevance of the issue is clear, as the issue of animal and poultry waste management is a priority in the development and conservation and protection of environment.

There are ways of remotely producing organic fertilizers where all possible ingredients can be used in different combinations (chalk, peat, chips, sawdust, straw, etc.). In the production of organic fertilizers, bird manure may be a constituent part of certain compositions and may have a negligible share in them. There are such patent proposals. These can be located anywhere, for example, near peat stocks. Different approaches to the disposal of manure can also be explained in different volumes. There are also ways to dispose of a large mass of manure, which is close to a poultry farm. The practice needs a second option [7].

The following technologies, patented to date, can be identified in the analysis of ideas on the use of avian manure:

1. Direct application to soil without any treatment.
2. Technology for processing by long-term storage.
3. Catalytic conversion technology: - biofermentation in chamber type units; -biofermentation in drum type units.
4. Processing by active composting in piles (options: aerobic solid-phase fermentation, biothermal method).
5. Processing by passive composting in piles (options: aerobic solid-phase fermentation, long-term composting, anaerobic fermentation technology, bioenergy method).
6. Cavitation method for disinfecting liquid manure and bird droppings.
7. Possible granulation thermal drying technology (option: thermal drying of manure at different temperatures).
8. Vacuum drying technologies.
9. Mechanical drying technology in pressure filters or centrifuge.
10. Vermicomposting (option: Processing of manure by insects and worms).
11. Microbiological conversion of manure and bird droppings.
12. Technology for the production of biogas (option: methane propagation).
13. Combustion technology for the production of alternative electrical energy.
14. Combustion technology for thermal power generation.
15. Pyrolysis (option: thermal decomposition of wastes without oxygen).
16. Biofuel technology.

Technology related to the production of organic fertilizers using environmentally sound technology through the treatment of organic wastes from cattle and poultry manure, which will effectively address the issue of

biotechnological recycling of poultry and livestock throughout the country, as well as improving soil fertility and organic farming. There is patent 2147 «Strain of bacteria *Lactobacillus acidophilus* KM-10, used to accelerate the process of processing of poultry manure» and to obtain as a result of high-quality organic fertilizer. The invention relates to agriculture and can be used for processing bird droppings.

Due to the fact that the organic waste from poultry production is 3.5 million tons/year. and cattle manure is 34 million tons. ton/year, 10 times as much as needed to dispose of manure. The aim was therefore to process poultry manure and, in order to save money, to replace straw and sawdust with cattle manure. As a result, a new method was developed to produce universal fertilizer from avian manure and cattle manure with the addition of *Lactobacillus acidophilus* KM-10, which was used to speed up the process of processing bird manure and was introduced in the production conditions of the «Astrakhan poultry factory»LLP.

The problem addressed by the proposed invention is the creation of a simple and inexpensive method for processing cattle manure and bird manure into organic fertilizer. Hen manure with litterfall and chicken manure without litter, with the addition of organic residues from cattle manure, should be used as bird manure.

Personal protective equipment will be used for manure and bird droppings handling.

There is no impact on the environment, except for emissions from machinery and machinery, as the project technology produces a waste-free organic product, bioactive fertilizers.

Advantages of using technology. The technology will sell clean, efficient fertilizers for crops:

Table

Market Volume Dynamics by Technology «EcoBio-Groups» for the last 10 years

Production	2008	2009	2010	2011	2012
«EcoBio-humus», tons	200,0	247,2	305,6	341,6	363,9
«EcoBio-humus», million tg	10,0	12,4	15,3	17,1	18,2
«EcoBio-fertilizer», thous. tg	450,0	556,2	687,5	768,7	818,8
«EcoBio-fertilizer», billion tg	0,9	1,1	1,4	1,5	1,6

Continious of the Table

Production	2013	2014	2015	2016	2017
«EcoBio-humus», tons	386,2	394,7	398,0	399,2	400,0
«EcoBio-humus», million tg	19,3	19,7	19,9	20,0	20,0
«EcoBio-fertilizer», thous. tg	869,0	888,2	895,5	898,3	900,0
«EcoBio-fertilizer», billion tg	1,7	1,8	1,8	1,8	1,8

- «EcoBio-fertilizer» consisting of organic compounds of carbon, hydrogen, oxygen, nitrogen, minerals phosphorus, calcium, potassium, magnesium, iron, manganese, etc.

- «EcoBio-humus» consisting of high molecular organic compounds of humic acid. They have a cyclic structure and minerals of phosphorus, calcium, potassium, magnesium, iron, manganese, etc.

- «EcoBio-bacteria» is a biological preparation for the acceleration of the process of bioconversion and improvement of agrochemical performance of finished compost of bird droppings.

- «EcoBio-vermi», breeding worms of the species Vladimir «Prospector», adapted to the climatic conditions of our country. The products of the technology have additional consumer properties for potential consumers of plant production and the population, which contribute to the improvement of the quality of agricultural products, enhancement of photosynthesis, stimulation of enzyme activity, to increase root formation and increase plant resistance to pesticides and herbicides.

Technology products will have a competitive advantage because of:

- «Supply chain» management will be the first industrial production in the country;

- there will be structural shifts on the side of intensive development of production and change of market share for organic fertilizer by 10 thousand tons, or on 20 million tenge, or 0.67%; market of bioactive fertilizer «Biohumus» by 500 tons, or on 25 million tenge, 5.0%; 12.0 ton or 2.4 million tenge or 20.0%; and 8.4 million tenge or 20.0% vermiculture market for bioconversion;

- our product is preferred because it is fully Kazakh content (100%), the product is very affordable, fully meets its technical and consumer characteristics, i.e., useful microchemical composition;

- will be industrial production in accordance with the requirements of introduction of business on «supply chain» management system;

- will be structural shifts on the side of intensive development of production;

- products will have a competitive advantage in both the domestic and the external market of the macro-region (level 1-4), then over domestic organic 38 fertilizers of natural origin, as well as foreign producers (especially Russian Federation) of organic fertilizers;

- The main points for advertising and marketing for the client to purchase our product are: «low cost», «biohumus - 100%», «domestic product», «quality packaging», «quality and ecology certificate», «fresh and available products», «Kazakhstan content - 100%».

As of 2018, the potential market is 3.5 million. tons (in monetary terms, 3 billion tenge) of organic fertilizers, 10 thousand tons. (in monetary terms, 500 million tenge) of bioactive (humus) fertilizer, and the amount of available market is 910 thousand tons. of (in monetary terms amounts to 1.8 billion tenge) of organic fertilizers, and for bioactive (humus) fertilizer 900 thousand tons (in monetary terms 45 million tenge) (Figure 4).

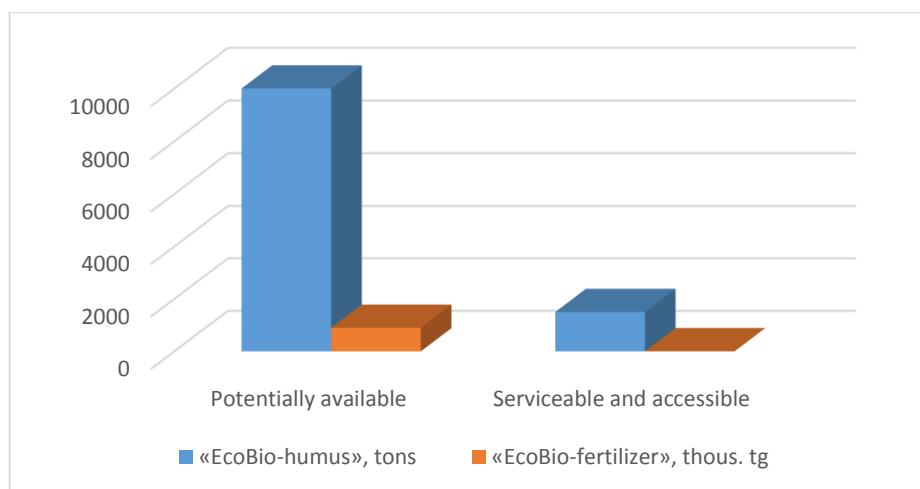


Fig. 4. Analysis of market volume by «EcoBio-group technology» in tons for 2018

**Environmental impact of technology.** Environmental problems such as:

- reduction and maximum elimination by useful technology of accumulated large quantities of chicken manure;
- reduction of environmental pollution from poultry waste;
- reduction of atmospheric pollution by reducing emissions of ammonia and hydrogen sulfide, hydrocarbons, nitrates, mercaptans;
- increase of green spaces, prevention of soil erosion;
- reproduction of soil fertility;
- development of organic farming;
- production of organic agricultural crops by increasing the development of organic fertilizers;
- improving environmental and health conditions;
- improved environmental awareness among staff and the population.

By technology, all the piles will be sprayed with water to maintain a certain humidity, eliminating the dust factor in the air.

Planting of trees and lawn will be replicated at all production sites, thus protecting the residential area from atmospheric pollutants.

**Conclusion.** As a result of the introduction of technology, there will be a number of positive social and economic consequences for the people and enterprises of the region in particular. The project will provide new jobs and attract the local population, improve the quality of life of the population and raise wages. Imports of organic fertilizers and increases in domestic organic production will be reduced, thus giving impetus to the production of organic crops and to the development of affordable organic farming. Subsequently, the population will use organic crops, without chemical preservatives, which will improve the health of the population and the gene pool in general.

Thus, the viability of this project is quite high, as the problem is topical, and it is the manure producers of cattle manure and bird manure, and the production of 3.5-4.0 million. tons of litter and manure per year will not stop the development of this technology. If the activity of the project is continued and after the completion of grant financing, it is planned that the created «legal entity» will be quite independent and the poultry plants themselves will finance the proposed project, and perhaps by that time environmental charges for waste disposal will have increased - «rates for installation of waste from production and consumption».

#### References

1. Duambekov M.S. Complex technologies for the development of natural resources of arid zones. - Taraz: TarSU, 2000. - 273 p.
2. Duambekov M.S. Ecology of Kazakhstan. - Astana, 2003. - 364 p.
3. Duambekov M.S. Ecological safety of the Caspian Sea. - Astana, 2003. - 392 p.
4. Ministry of Environmental Protection of the Republic of Kazakhstan [Electronic resource]. Access mode: <http://www.eco.gov.kz>
5. Duambekov M.S., Orazov E.T. Information technologies for solving problems of regional ecology. - Taraz, 1999. - 132 p.
6. Sukhoverkova V.E. Methods of utilization of bird droppings, presented in modern patents // Bulletin of the Altai Agrarian University. - 2016. - No.9. - p.143-148.
7. Marketing research: agriculture of Kazakhstan [Electronic resource]. Access mode: <http://www.marketingcenter.kz/2017/03-07>
8. Duambekov M.S. Instruments and measuring instruments for monitoring the state of the environment: textbook. - Astana: Folio, 2008. - 336 p.
9. Akbasova A.Zh., Duambekov M.S., Saynova G.A. Soil protection: textbook. - Astana: Folio, 2008. - 296 p.

---

Material received 14.06.21.

**С.Т. Дүйсенбаева**

*М.Х. Дулати атындағы Тараз өңірлік университеті, Тараз қ., Қазақстан*

**Андатпа.** Мақалада биологиялық ашыту әдісімен жануарлар мен құстардың қалдықтарынан органикалық тыңайтқыштар алу технологиясы қарастырылған. Ғылыми жұмыстың мақсаты - мал мен құс қалдықтарын биологиялық ашыту әдісімен өңдеудің ғылыми-зерттеу технологияларын коммерциализациялау. Мақалада экологиялық таза технологияны қолдана отырып, мал мен құс қалдықтарын қайта өңдеу арқылы органикалық тыңайтқыштар өндірісін құру мәселелері талқыланады, бұл топырақтың құнарлылығын арттыру және органикалық егіншілікті дамыту мәселелерін тиімді шешуге мүмкіндік береді.

**Тірек сөздер:** атмосфера, органикалық қалдықтар, құс өсіру, мал шаруашылығы, қоршаған ортаның ластануы, қайта өңдеу, генофонд.

**С.Т. Дүйсенбаева**

*Таразский региональный университет им. М.Х. Дулати, г. Тараз, Казахстан*

#### **ТЕХНОЛОГИЯ ПРОИЗВОДСТВА ОРГАНИЧЕСКОГО УДОБРЕНИЯ ИЗ ЖИВОТНОВОДЧЕСКИХ И ПТИЦЕВОДЧЕСКИХ ОТХОДОВ МЕТОДОМ БИОЛОГИЧЕСКОЙ ФЕРМЕНТАЦИИ**

**Аннотация.** Данная статья исследует технологию производства органического удобрения из животноводческих и птицеводческих отходов методом биологической ферментации. В статье рассмотрены вопросы создания производства органических удобрений по экологически чистой технологии с помощью обработки животноводческих и птицеводческих отходов, которая будет способствовать обеспечению эффективного решения проблемы улучшения плодородия почв и развитие органического земледелия.

**Ключевые слова:** атмосфера, органические отходы, птицеводство, животноводство, загрязнение окружающей среды, переработка, генофонд.