

ANNOTATION

on the dissertation work of Makpal Bostubayeva on the topic: «Development of microbiological technology for processing sewage sludge into organic fertilizer» within the framework of the educational program 8D08103 – Scientific basis of plant nutrition and fertilizer application.

Relevance of the topic. The problem of disposal of sewage sludge belongs to all the cities of the world. Accumulation of sludge in landfills is always considered one of the main environmental problems.

The analysis of the current situation of sewage sludge recycling in the cities of Astana and Almaty revealed that there is no effective technology for the disposal of sludge in the country, and it is undoubtedly known that the storage of sludge in landfills poses a biological and toxicological threat to people. In Kazakhstan, the problem of wastewater recycling is urgent, and if recycling technology is not implemented, this problem may lead to an environmental disaster in the near future. The growth of the city's population requires an increase in water supply and sewage capacity. If this trend continues, it will lead to the formation of large masses of sewage sludge.

Sludge is produced as a result of wastewater treatment. Sludge is often disposed of by discharge into water bodies, burial in sludge sites, or incineration. However, due to the environmental impurity of these methods, work is underway to develop technologies that enable the use of sewage sludge in the production of building materials, biofuel, activated carbon, electricity, and fertilizers. Sludge contains a large amount of phosphorus and nitrogen, which is the main prerequisite for the possibility of using it as an organic fertilizer. It includes water, organic matter and mineral nutrients. The dry matter of muddy sediments contains 25–35% carbon, 4–5% nitrogen, 2–3% phosphorus, potassium, trace elements.

Currently, widely used sludge reprocessing technologies include aerobic/anaerobic digestion, incineration, pyrolysis, and gasification. Most of the member countries of the European Union have the practice of incineration of sewage sludge. Incineration reduces the volume of sludge by 90%. Ash residues are used for production of building materials. The heat generated during combustion produces steam, which is then converted into energy by steam turbines. The high content of phosphorus in coal and ash and the low content of heavy metals make it a potential source of phosphorus fertilizers for agriculture. But a number of disadvantages of this method include the high cost of burning technology, a large amount of greenhouse gas emissions.

Long-term accumulation of sludge in special plots and landfills is widespread in the CIS countries. The use of this method of waste management is associated with its low capital costs. However, this method is limited by the capabilities of storage facilities, does not meet environmental safety requirements, increases the risk of negative impact on the environment, and leads to irreversible loss of energy and resource potential of sludge.

However, due to the presence of heavy metals, pathogens, pesticides and other toxic substances in sewage sludge, it is necessary to take into account the risk of environmental pollution when using it as a fertilizer. Sewage sludge is not suitable for direct use on the soil, it belongs to the 4th class of danger and is a source of unpleasant smell.

One of the environmentally friendly solutions for recycling sludge is to store sludge together with other organic waste. Compost contains a variety of microorganisms capable of breaking down natural biopolymers such as proteins, lignin, and cellulose, as well as other organic molecules. Sludge storage allows to reduce its volume, and this technological process is not associated with emissions of harmful substances compared to incineration, and is environmentally friendly. In the process of mining, sludge undergoes physical and chemical changes and becomes a disinfected, rich, stable product.

Due to the above-mentioned problems, the development of biopreparations based on microorganisms isolated from sludge sediments for its effective processing into organic fertilizer, elimination of unpleasant odors and further use in agro-landscape farming is an urgent issue .

Degree of study of the research topic.

who considered the problem of recycling sludge into organic fertilizer include O.A.Petrov (2013), K.T.Ospanova (2015), M.S.Duambekov (2018), It is possible to mention the works of E.Zh. Khasenova (2020), Z.Kh. Kunasheva (2023) . However, in these studies, there is insufficient data base on changes in chemical properties and microbiological indicators of sludge deposits during storage. In addition, there are no studies on the use of sludge as a fertilizer for the cultivation of decorative plants. Due to this, the degree of research of the given topic is considered to be low and its relevance increases.

The purpose and objectives of the research:

The purpose of the work: to develop a microbiological technology for recycling sludge into organic fertilizer.

According to the purpose of the research, the following tasks are put forward:

1. Study of physico-chemical properties and composition of heavy metals, determination of microbiological composition of untreated sludge of "Astana Su Arnasy".
2. Study of the properties of growth promotion of different concentrations of sewage sludge in relation to test crops.
3. Isolation of microorganisms found in sludge sediments, study of their biological features and creation of consortia based on effective microorganisms.
4. Development of regulations for the production of biological preparations from microorganisms used in the processing of sewage sludge into organic fertilizer.
for storage of sludge using new biological preparations : study of temperature regime, determination of pH, humidity, chemical composition of compost.
6. Application of organic fertilizers made on the basis of muddy sediments in agro-landscape farming and study of the effect on the chemical composition of the soil.

7. Evaluation of the potential market for the use of organic fertilizer made on the basis of sludge.

Forms of research: sewage sludge, microorganism strains, biopreparation, lawn, amaranth.

Research subject: Microbiological technology of sewage sludge recycling into organic fertilizer.

Research methods: laboratory, field and mathematical methods were used during the research.

Scientific news. For the first time in the country, an effective microbiological technology for recycling sludge into organic fertilizer was developed. In the course of the research work, beneficial strains of nitrogen-fixing, cellulose-decomposing and growth-stimulating, highly active, useful microorganisms were selected for recycling sludge into organic fertilizer. Two different consortia of effective strains of microorganisms living in sludge were created and tested for sludge reclamation. For the first time, the possibilities of using fertilizers obtained from sewage sludge in agro-landscape farming for lawn plants and decorative amaranth were considered.

Theoretical and practical significance of the research results: for the first time in Kazakhstan, new strains of microorganisms were isolated from muddy sediments, their biological features were thoroughly studied, and effective strains of microorganisms were selected. Two biopreparations were created from the isolated effective microorganisms, and they were used for stockpiling of sludge in industrial conditions. The recycling technology developed during the research can be used in utilities and enterprises involved in the production of sewage sludge. The results of studies on the use of sewage sludge in agro-landscape farming are important for entrepreneurs working in the field of gardening and landscaping.

The main principles recommended for protection:

- New strains of microorganisms were isolated from the composition of the sludge, and their biological features were studied, effective microorganisms were selected and identified.

- The efficiency of using biological preparations of microbial origin for stockpiling of sludge was studied.

- of organic fertilizers made from sludge in agro-landscape farming on soil fertility and biomass of plants was considered.

- for the use of organic fertilizers obtained from sludge was evaluated.

Approbation of dissertation results. The main results of the research work were discussed at the following international conferences: "Academics and Science Reviews Materials" (International scientific-practical conference. Helsinki, Finland, 2022), "Adaptation of crop production to the conditions of global climate change: problems and solutions" (International scientific-practical conference, Almaty, 2022), "Seifullin readings-18(2): "Science of the XXI century - the era of transformation" (International scientific and practical conference, Astana, 2022), "M.A. "Seifullin readings - 19" dedicated to the 110th anniversary of Handelman (International Scientific and Practical Conference, Astana, 2023).

Research publications.

The main results of the dissertation were presented in 12 publications, including 2 articles in the Eurasian Journal of soil science (percentile - 48%), Caspian Journal of Environmental Sciences (percentile - 44%) included in the international Scopus database, 3 articles were published in publications presented by the Committee of the Ministry of Education of the Republic of Kazakhstan, 1 article included in the R&D (RINC) database, 4 articles in the collection of international conferences were published. 1 permission for patent of utility model of the Republic of Kazakhstan was received and 1 practical recommendation was published.

Dissertation connection with state programs. Dissertation work within the framework of grant funding for scientific and (or) scientific and technical projects for the years 2022-2024, on October 18, 2022, in accordance with the agreement №250/30-22-24 within the framework of the project entitled AP14871144 "Development of technology for processing sewage sludge and "green" wastes of urban plantations into organic fertilizer using domestic biological products"

The structure and scope of the dissertation. Dissertation work consists of introduction, review of literature, research materials and methods, research results, conclusion, used literature and appendices. The number of used literature is 299, including 140 foreign language literature. The dissertation has 141 pages, 44 tables, 17 pictures.

Сведения о документе

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ФИО	Дата и время	Результат	ЭЦП
Шаймерденова Алия Какымовна	-	Очередь не наступила	
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2003 жылғы 7 қаңтардағы № 370-ІІ «Электрондық құжат және электрондық цифрлық қолтаңба» туралы ҚР Заңының 7-бабы 1 тармағына сәйкес қол қоюға өкілеттігі бар адамның электрондық цифрлық қолтаңбасы арқылы куәландырылған. Осы құжат қағаз жеткізгіштегі қол қойылған құжатпен бірдей.

Данный документ согласно пункту 1 статьи 7 ЗРК от 7 января 2003 года № 370-ІІ «Об электронном документе и электронной цифровой подписи», удостоверенный посредством электронной цифровой подписи лица, имеющего полномочия на его подписание, равнозначен подписанному документу на бумажном носителе.