ANNOTATION

dissertation work of Jumasheva Kamshat Abilovna on the topic:
«Environmental assessment of reducing the load of excess sludge from urban wastewater on the environment»,
submitted for the degree of Doctor of Philosophy (PhD) in the educational program 8D060800 – Ecology

As a result of the vital activity of mankind, that is, the satisfaction of people's household needs, the use of various technologies in various sectors of the national economy, and agricultural work, a large amount of wastewater and waste water is generated. The sludge-forming sediment contains a number of substances with carcinogenic, toxigenic and embryotoxic properties. It contains both pathogenic microorganisms and a number of toxic compounds in the form of heavy metals, pesticides, nitrosamines, phenols and esters. It is known that the presence of harmful substances, depending on the concentration released by sludge-forming sediments, can exceed the standards of maximum permissible concentrations, with the release of an unpleasant gaseous toxic odor.

The treatment and reuse of solid waste and waste water polluting the environment, the neutralization and reuse of urban wastewater (sewage) waters are urgent issues of our time for every country in the world.

Precipitation formed during the technical treatment of urban wastewater is very dangerous, has low dehydration, the percentage of humidity is more than 96%, contains some pathogenic and organic substances, as well as heavy metals.

In the Mangystau region of Aktau at a sewage treatment plant, sewage sludge is mainly accumulated on silt sites after minimal treatment.

The relevance of the work is aimed at studying the territory of sewer systems, pollution of the gas-air environment, soil, the presence of pathogenic microorganisms, an unfavorable sanitary and epidemiological condition, and the proposal to use a natural sorbent, which will significantly improve the state of the environment and reduce the unfavorable background of this territory.

Rationale for the need for this research work:

The problem of such a negative effect of the raw sediment of urban wastewater can be solved by using a natural sorbent – diatomite. Diatomite has high porosity and low density. They are characterized by the ability to adsorb, weak thermal and sound conductivity, refractory and acid resistance. It is used as an adsorbent and filter in the textile, petrochemical, food industry, in the production of antibiotics, paper, various plastic materials, paints; as a raw material for liquid glass and glaze; as a building heat and sound insulation material. The addition of diatomite protects against frost (diatomite was heated for a long time and the roots froze later, as a result, the tree bloomed later), and in summer − from drought (diatomite absorbed and retained moisture). Being a sedimentary rock consisting of the remains of ancient marine diatoms, it prevents and suppresses pests, increases soil fertility, and increases yields. When diatomites are introduced into soils, it increases its buffering and adsorption properties, and also helps to reduce iron and aluminum intoxication of plants, which is especially important for acidic soils. It suppresses the number of pathogenic and parasitic microorganisms that predominate in the composition of the raw sludge of urban wastewater, eliminates the smell of sludge, accelerates the natural drying time in silt fields.

Thus, solving the problem of storing raw sludge by applying the natural sorbent diatomite will greatly improve the gas-air background of the tourist city, by maximizing the elimination of the smell of sludge near the residential area "Primorsky", located near sewage treatment plants.

The purpose of the dissertation: The purpose of the work is to assess the environmental condition of the sludge sludge of urban wastewater and determine the effectiveness of the use of natural sorbents for its disinfection and reducing the environmental burden.

Research objectives:

- identification of the most effective methods of disinfection and disposal of sludge abroad and in Kazakhstan and assessment of its impact on the environment.

- study of the composition of sludge and the natural sorbents used for its further utilization.

- - analysis and assessment of the current state of the territory of the sewage treatment plant and the problems of treatment, utilization and disinfection of sewage sludge.

- research to determine the sanitary-parasitological and sanitary-microbiological composition of sludge sludge.

research on the selection of the most effective natural sorbent for disinfection and dewatering of sludge sludge in order to prevent adverse environmental effects.

Subject of study - sludge sludge of urban wastewater sewerage

The subject of the study: excess sludge from urban wastewater, its impact on environmental objects such as atmospheric air, soil, and the health status of residents of adjacent territories. The study focuses on the use of a natural sorbent, which will help reduce the time of natural drying in silt fields, reduce the amount of moisture in the sludge, eliminate bad odor by reducing the volume of organic sulfur, destroy parasitic helminths of animal origin, and subsequently allow safe use for agricultural purposes or landscaping urban areas.

Research methods:

- analysis of scientific and technical literature on the research topic;
- research on the possible improvement of the gas-air environment;
- laboratory studies and analysis of the effectiveness of the use of diatomite in urban landscaping;
- a detailed assessment of the introduction of a natural sorbent into the technology of disinfection and dehydration of raw sludge.

The main provisions submitted for protection:

1. Data on the content of pollutants in the atmosphere of the territory and on the composition of mobile sulfur in soils on the territory of sewage treatment plants for four seasons.

2. Correlations between the content of hydrogen sulfide and mobile sulfur in the soil.

3. Mathematical modeling and optimal parameters of the drying time (15-20 days) of raw sludge and the ratio of natural sorbent to sludge (1:0.1) for its dehydration and disinfection.

4. Ecological and economic efficiency of the use of natural sorbents to reduce the load of sludge from urban wastewater on the environment.

The completed dissertation work has a connection with other studies on the effective use of sewage waste.

The scientific novelty of the work: it consists in the use of a safe multifunctional natural sorbent for the destruction of parasitic helminths and the destruction of bad odors, which significantly reduces the level of man-made environmental stress. The finished product will be highly safe, have a variety of organic elements in its composition, contributing to the rapid restoration of degraded lands.

Substantiation of the novelty and importance of the results obtained:

The novelty and importance of the results obtained is confirmed by the acts of introduction into the technology of sewage treatment systems of the State Enterprise «Kaspiy Zhylu, Su Arnasy», the RSE at the Mangyshlak Botanical Garden of the KN of the Ministry of Internal Affairs of the Republic of Kazakhstan for effective use in urban greening research.

Practical significance of the work: The results of an ecotoxicological assessment of pollution of the urban ecosystem with organic and inorganic sulfur, methane can be used in a comprehensive assessment of environmental quality targets, in the development of projects to assess the impact of economic activities on the environment, as well as as recommendations for

regions where atmospheric pollution with hydrogen sulfide is observed from various sources, for example, when oil and natural gas refining, emissions from wastewater treatment plants and landfills, natural gas production plants, paper mills, manure processing plants, etc. The results of analyses of the effectiveness of the use of natural sorbent in the technology of sewage treatment plants will improve the condition of environmental components, and increase the fertilizing qualities of dry sewage sludge.

Compliance with the directions of scientific development or state programs: The dissertation solves the problem of high content of gaseous pollutants in the technology of utilization of raw sludge sludge, destruction of parasitic microorganisms in its composition, reduction of the toxic smell of sludge, and effective use of dry sludge by mixing sludge and natural sorbent diatomite.

The personal contribution of the author is that laboratory analyses of the effectiveness of diatomite by sowing plants and the idea contained in the received act of implementation were obtained and developed personally by the applicant. The author independently outlined the purpose, objectives and plan of the ongoing research on the ecotoxicological assessment of pollution of the urban ecosystem with hydrogen sulfide and methane in the city of Aktau, carried out the determination of pollutants in the atmosphere, soil sampling, laboratory physico-chemical analyses, experimental and field studies. The analysis and generalization of the experimental results of the work with the identification of a correlation between the content of hydrogen sulfide in the atmosphere and sulfur in the soil, as well as its effect on public health. Research has been conducted to improve the quality of degraded lands by sowing agricultural crops in the laboratory of the Caspian University of Technology and Engineering named after Sh.Yesenov. The task statement and discussion of the results were carried out jointly with scientific consultants.

Reliability of the results: The reliability of theoretical scientific statements, conclusions and recommendations is confirmed by the fact that they are based on laboratory analysis results.

Description of the main research results: Based on the results of the studies performed, the following main conclusions can be drawn:

1. The analysis of existing methods for the effective use of raw and dry sludge of urban wastewater, and the dangers of natural drying in the open air. The analysis showed the negativity and danger of raw sediment and showed the need for its mandatory disinfection by new modern methods without harm to the environment.

2. The analysis of the effectiveness of the use of the natural sorbent diatomite in landscaping and improvement of degraded lands was carried out. Laboratory and practical analysis has shown the stability of plant growth with a limited amount of diatomite.

3. The analysis of the effectiveness of the use of diatomite in the disinfection and dehydration of crude sludge was carried out. Laboratory analysis revealed the effectiveness of the use of diatomite in the disinfection and dehydration of raw sewage sludge, by reducing the harmfulness and danger of sediment, destroying parasitic microorganisms, and eliminating the smell of "rotten eggs".

4. The analysis of the effect of crude sludge on environmental components: soil, water, atmospheric air, and public health has been performed. Laboratory and practical analysis revealed heavy metals, greenhouse gases, and parasitic microorganisms in the sediment content.

The studies performed and the results obtained correspond to the best achievements in the field of use, disinfection and dewatering of sludge.

Publications and approbation of the work:

Based on the materials of the dissertation, 11 scientific papers have been published, of which: 3 articles in the journal included in the Scopus database, (Study on the composition and environmental impact of sewage sludge. Journal of Ecological Engineering, 2023, 24(3), Polish. Pp. 315-322. 51 percentile; World experience in the use of excess sewage sludge. ActaInnovations, November 2023. №50:18-28-18. 2023 RICPro-Akademia – CCBY, Polish. Pp. 18-28, 51 percentile; An overview of the methods of utilization of the areas of use and

processing of sewage sludge. Ecology and Industry of Russia, 2024. Vol. 28. No. 7. - pp. 66-71.- 20th percentile);1 article of scientific and practical conferences included in the Scopus database (Modern methods of treatment and disposal of sewage sludge. International Scientific conference «Ecologicaland Biological Well-Being of Flora and Fauna», Blagoveschensk, Amur region, Russia, May 22-25, 2023. Pp 1-5. 25 процентиль), 2 статьи в отечественном журнале «YessenovJournal»,

the rest of the articles are in the collections of international scientific and practical conferences.

As part of the tasks of the dissertation work, certificates of implementation were obtained from the State Enterprise «Kaspiy Zhylu, Su Arnasy», the RSE at the Mangyshlak Botanical Garden of the KN of the Ministry of Internal Affairs of the Republic of Kazakhstan for effective use in urban greening research.

Description of the doctoral student's contribution to the preparation of each publication:

All mentioned publications are based on the doctoral student's dissertation work and reflect all its sections. The results presented in the sections were obtained personally by the applicant and discussed by scientific consultants.

Based on the materials of the dissertation, 11 scientific papers have been published. The scientific results of the research work were discussed in published scientific articles of the dissertation, at international scientific conferences and journals included in the Scopus database:

1. Jumasheva K.A., Kenzhetaev G.J. Seidalieva L.H. Methods of disinfection of precipitation of urban wastewater treatment plants. «Formation of ecological culture and consciousness» materials of the republican scientific and practical conference. May 24, 2019. Aktau, Kazakhstan.- Pp.203-206

2. Jumasheva K.A. The use of activated sludge waste. "Digital technologies in industry": materials of the republican scientific and practical conference-March 28, 2019. Aktau, Kazakhstan.- Pp..-194-199

3. Jumasheva K., Syrlybekkyzy S., Suleimenova B., Serikbayeva A., Nurbayeva F. Conversion of waste sewage sludge. «Internauka»: scientific journal No. 19(289). Part 7. Moscow, Publishing house «Internauka», 2023. Pp. 33-38. ISSN 2687-0142

4. Jumasheva K, Baimukasheva Sh., Syrlybekkyzy S, Suleimenova B., Taizhanova L., Nurbayeva F. Methods of disinfection of precipitation urban sewage treatment plants. «Internauka»: scientific journal – № 19(289). Часть 7. Moscow, Publishing house «Internauka», 2023. С. 38-41. ISSN 2687-0142

5. Jumasheva K., Syrlybekkyzy S, Serikbayeva A.K,. Nurbaeva F.K.,Kolesnikov A.S. Study on the composition and environmental impact of sewage sludge. Journal of Ecological Engineering, 2023, 24(3), Polish. Pp. 315-322. 51 процентиль

6. Jumasheva K., S.Syrlybekkyzy, A.Serikbayeva, B. Suleimenova, Zh. Altybayeva. Modern methods of treatment and disposal of sewage sludge. International Scientific conference «Ecological and Biological Well-Being of Flora and Fauna», Blagoveschensk, Amur region, Russia, May 22-25, 2023. Pp 1-5. 25 процентиль

7. Jumasheva K. , Syrlybekkyzy S., Serikbayeva A., Nurbayeva F. , Kolesnikov A. , Zh. Bessimbayeva, Zh. Uisimbayeva. World experience in the use of excess sewage sludge. Acta Innovations, November 2023. №50:18-28-18. https://doi.org/10.32933/ActaInnovations.50.2 ISSN 2300-5599, 2023 RIC Pro-Akademia – CC BY, Polish Pp. 18-28. 51 процентиль

8. Jumasheva K.A., S. Syrlybekkyzy, A.G. Gusmanova, F.K. Nurbayeva, A.S. Kolesnikov, I.V. Volkova. An overview of the methods of utilization of the areas of use and processing of sewage sludge. Ecology and Industry of Russia, 2024. Vol. 28. No. 7. - pp. 66-71. 20 percentile

9. Jumasheva K.A., Kenzhetaev G.Zh., Serikbayeva A.K., Syrlybekkyzy S.The impact of open sewage treatment plant CBS-1 treatment systems on the environment. "Geological and technological aspects of the development of deposits of hard-to-recover hydrocarbons" materials

of the international scientific and practical conference. April 18, 2019. Aktau, Kazakhstan.Pp. 90-92.

10. Jumasheva K. A., Nurbaeva F. K. Review of methods of disinfection of waste water bed.Yessenov Science Journal №1 -2023 ///Vol.44 (1) p.99-104

11. Jumasheva K. A., Nurbaeva F. K. Determination of risk on the example of a city wastewater treatment station.International scientific journal «Global science and innovations 2022: Central Asia» Astana, Kazakhstan, December, 2022, Pp. 21-26