



## REVIEW

of the domestic scientific consultant Turgut Tüzün Onay on the dissertation work of Dzhumasheva Kamshat Abilovna "Ecological assessment of reducing the load of excess sludge of urban wastewater on the environment", submitted for the degree of Doctor of Philosophy (PhD) under the educational program 8D05201 (6D060800) – Ecology.

### **The relevance of the thesis topic:**

The dissertation is devoted to an urgent issue - pollution of the environment by sludge from sewage municipal wastewater.

Sewage treatment plants for domestic wastewater are a complex of engineering structures aimed at removing pollutants contained in domestic wastewater.

Aktau sewage treatment plants are located in the immediate vicinity of the Caspian Sea coast 200 m, as well as from the Primorsky residential area 100 m, posing a threat to public health.

Due to the annual increase in the population of the Mangystau region, the volume of waste generated, including excess activated sludge from urban wastewater, is also increasing. The resulting secondary sediments are divided into the following main categories: organic sediments of mineral structure and activated sludge. Before dehydration, organic precipitation is normalized by fermentation or stabilization, as well as by thermosetting.

The sediment stored on silt sites is infected with dangerous bacteria that can cause various forms of infectious diseases, contains a large number of helminth eggs, heavy metal compounds of various shapes. The exploitation of silt maps leads to the loss of valuable lands, soil pollution, the spread of unpleasant odors, the accumulation of heavy metal salts, as well as the spread of negative microbiological and gas background, which negatively affects the environment and human health.

When entering treatment facilities, wastewater contains mineral pollutants of various composition and content: clay particles, coarse sand, fatty oils, heavy metal ions; organic: oily sediments, hair, household solid waste, feces; bacterial: algae, microorganisms, yeast and moldy fungi; various suspended solids. Wastewater, passing through several stages of purification, forms sludge, which cannot be treated, except for dehydration and drying in a natural condition.

The difficulty in this case is the need for a long time for natural drying and the allocation of huge areas for silt maps. The presence of a large volume of excess sludge leads to the spread of an unfavorable gas-air background, contamination of groundwater and soil with toxic substances contained in the sediment.

Thus, an environmentally friendly solution to this problem is needed. Environmental improvement is possible through the use of natural sorbents, which will reduce the anthropogenic load on environmental components. Thus, the use of diatomite sorbent will be an excellent solution to reduce the unfavorable background of this area and is an *urgent and practical task*.

### **The validity of scientific statements, conclusions and recommendations, their reliability and novelty:**

Based on the conducted complex of theoretical and experimental studies, the author has established the following.

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. Suppresses the number of pathogenic and parasitic microorganisms that predominate in the composition of the raw sludge of urban wastewater, eliminates the foul-smelling odor of sediment, accelerates the natural drying time in silt fields.

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

#### **Scientific and practical significance of the new results obtained in the work:**

The scientific significance of the work lies in the fact that it was shown for the first time that the content and composition of raw sludge has a dangerous and negative impact on the environment. In order to determine the danger, studies were conducted on the physico-chemical composition, on the sanitary and microbiological composition of the sludge. The identified parasitic microorganisms are the most resistant in the natural environment. Also, during the natural drying of raw sludge, gaseous substances are selected, such as methane, ammonia, and hydrogen sulfide have a significant impact on the health of the population living near the treatment areas.

The main source of pollution of environmental components as a result of the study was inorganic sulfur, which exhibits a foul-smelling odor and other adverse effects. The use of the sorbent in certain doses indicated in the research and laboratory results indicate the positive properties of the dry sediment for its further use for landscaping urban plantations without harm to the environment.

The results of the dissertation work are of great practical importance in the greening of urban plantations, in the application of methods that improve soil quality for sowing and restoration of degraded lands.

#### **Completeness of coverage of the results obtained and published works:**

The main provisions of the dissertation have been published in 7 printed works in scientific specialized publications (including 3 that are indexed in the scientometric database Scopus), and 5 articles in international scientific publications, conferences.

As part of the tasks of the dissertation work, certificates of implementation with the State Municipal Enterprise "Kaspiy Zhylu, Su Arnasy", the RSE CEC "Mangyshlak Experimental Botanical Garden" of the Science Committee of the Ministry of Education and Science of the Republic of Kazakhstan were obtained for effective use in research on urban landscaping

#### **Recommendations for further use of scientific results:**

It is recommended to use the results obtained in the dissertation work:

- research organizations that study the processes of fertilizer development in the soil;
- design organizations that are engaged in the secondary use of dry sludge in industry, agriculture and in the construction of road surfaces;
- production organizations that have stable toxic gases in their technology.

#### **Assessment of the main content of the work:**

The text of the dissertation consists of an introduction, 4 sections, conclusions, a list of sources used and appendices.

All sections have completed content, contain a sufficient amount of information and end with conclusions on the section.

The first section provides a general description of the technology for the disposal of crude sludge, provides information on existing methods of dehydration and disinfection, and provides a critical analysis of the methods used worldwide.

The second section is devoted to the review and analysis of the current state of the KOS-1 territory. The characteristics of wastewater, its composition and properties, its effects on water bodies, soil and atmospheric air are given.

In the third section, the indicators and properties of known types of natural sorbents are given. A complete description of the qualitative analysis of the studied natural sorbent diatomite, its

composition and useful properties suitable for soil fertilization is given. An analysis of the effectiveness of the listed types of natural sorbents is given.

The fourth section provides a complete analysis of the composition of sewage sludge and its impact on the environment. Laboratory and scientific studies were carried out on the composition of sludge, on its effect on environmental components, as well as an analysis of the effective dose of dry sludge for its further use in the national economy.

The volume and scientific and technical level of the research performed are sufficient for a dissertation for the degree of Doctor of Philosophy PhD.

**Compliance with the directions of scientific development or government 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, reducing the level of foul-smelling 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 studies. The analysis and generalization of 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, is carried out. Research has been conducted to improve the quality of degraded lands by sowing crops in the laboratory of the Caspian University of Technology and Engineering named after Sh. Yessenov. The task statement and discussion of the results were carried out jointly with scientific consultants.

**Conclusions:**

The dissertation of Dzhumasheva Kamshat Abilovna "Ecological assessment of reducing the load of excess sludge from urban wastewater on the environment" is a completed research work, which provides a solution to an urgent task - mixing raw sludge with a natural sorbent diatomite, the purpose of which is the destruction of parasitic microorganisms, the destruction of a foul-smelling odor, increasing the efficiency of dry sludge for its further use applications in urban landscaping.

The dissertation is written in a clear and concise language, the purpose and objectives of the research are correctly set, the scientific provisions are argumentatively disclosed. The content of the dissertation is sufficiently reflected in the publications.

The dissertation work meets the requirements for dissertations for the degree of Doctor of Philosophy PhD, and its author Dzhumasheva Kamshat Abilovna deserves to be awarded the degree of Doctor of Philosophy PhD in the educational program 8D05201 (6D060800) – Ecology.

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