

ANNOTATION

dissertation work of Ryskalieva Damila on the topic: « Ecotoxicological assessment of pollution of the urban ecosystem with hydrogen sulfide in the conditions of the city of Atyrau », submitted for the degree of Doctor of Philosophy (PhD) in the specialty 8D05201-Ecology

Assessment of the current state of the solved scientific or scientific-technological problem

The topic of the dissertation is devoted to the problems of pollution of the urban ecosystem of Atyrau with hydrogen sulfide. Atyrau region occupies a special place among the regions and zones of ecological disaster in Kazakhstan. The ecological situation here is formed under the influence of natural and anthropogenic factors, the most important of which are the rapid development of the oil and gas complex. A large number of the Atyrau region's population comes into contact with oil and its refined products, as well as with other toxic and carcinogenic chemicals that are released into the environment and have a harmful effect on both workers and the population who do not have professional contacts with oil. In Atyrau region, solid particles, sulfur dioxide, carbon monoxide, nitrogen oxides and hydrocarbons are released into the atmosphere during the operation of oil fields. Air pollution has been one of the urgent problems in the Atyrau region for many years. Due to the deterioration of air quality in the region, more and more people have health problems.

The relevance of the topic. This paper presents the results of studies of atmospheric pollution with hydrogen sulfide in Atyrau, their correlation with the accumulation of sulfur in the soil and the effects on public health. The environmental situation in Atyrau has sharply worsened due to pollution of the city's air basin with hydrogen sulfide, especially in spring and summer. Against the background of demographic problems, the negative impact of oil and petroleum products on the human body can increase many times. Therefore, an in-depth comprehensive scientific study of the health status of the region's population is necessary. Hydrogen sulfide is the most frequently reported pollutant. This chemical element is formed during the decomposition of proteins and is part of the gas mixture present in sewers and sewers, and can accumulate in basements. It is found in the air in landfills, and is also present in large quantities in natural sources such as oil, natural gas, as well as emissions from volcanic and sulfur sources. Human exposure to H₂S and its toxic effects become more severe with increasing concentration and duration of exposure and primarily affect the respiratory, cardiovascular and nervous systems. Short-term exposure to high concentrations of H₂S can be fatal, while long-term exposure to even low levels of H₂S in the environment can cause health problems in humans. Therefore, a comprehensive scientific study of the dependence of the effects of hydrogen sulfide on the health of the population of the region is necessary. Air pollution has serious health consequences, especially for people living in cities. One of the most common problems associated with air pollution is an increase in the incidence of respiratory diseases.

In this regard, studies aimed at conducting an ecotoxicological assessment of pollution of the urban ecosystem of Atyrau with hydrogen sulfide are very relevant.

This dissertation work involves conducting research on monitoring the content of hydrogen sulfide in the atmosphere, the accumulation of sulfur in the soil and the identification of types of diseases that are subject to an increase from exposure to hydrogen sulfide.

The purpose and objectives of the study. The purpose of the dissertation is to conduct an ecotoxicological assessment of pollution of the urban ecosystem with hydrogen sulfide in the conditions of the city of Atyrau with the determination of the correlation between the content of hydrogen sulfide in the atmosphere and the content of sulfur in the soil, as well as its impact on public health.

To achieve this goal, the following tasks are set:

- analysis of the state of air pollution in Atyrau;
- analysis of the morbidity rate of the Atyrau city population;
- study of the mechanism of sulfur formation and the consequences of its release into the environment;
- study of the ecotoxicology and toxicology of hydrogen sulfide and their effects on living organisms;
- conducting research on the content of hydrogen sulfide in the air of the city of Atyrau for four seasons of the year;
- conducting research on the content of mobile sulfur in the soil of Atyrau and determining the correlation between the content of hydrogen sulfide in the air and mobile sulfur in the soil;
- analysis of the relationship between the number of sick residents of Atyrau, the correlation between mortality and the content of hydrogen sulfide in the air;
- analysis of recommendations for the population on the prevention of hydrogen sulfide poisoning;
- analysis of methods for cleaning air and wastewater from hydrogen sulfide and sulfur compounds.

The idea of the work is an ecotoxicological assessment of pollution of the urban ecosystem with hydrogen sulfide in the conditions of the city of Atyrau, on the basis of which a correlation analysis of the relationship between the content of hydrogen sulfide in the atmosphere and the content of mobile sulfur in the soil, as well as with the level of morbidity and mortality of the population with hydrogen sulfide content, which showed a positive correlation with diseases of the respiratory system. Based on the results obtained, recommendations are proposed to the population for the prevention of hydrogen sulfide poisoning and methods for cleaning the atmosphere from hydrogen sulfide in industrial conditions and wastewater, which are the main sources of hydrogen sulfide entering the atmosphere.

The object of the study is the atmospheric air, soil and population of the city of Atyrau, located in the western part of the Republic of Kazakhstan.

The subject of the study. To study the ecotoxicological assessment of pollution of the urban ecosystem with hydrogen sulfide in the conditions of the city of Atyrau with the proposal of recommendations for the prevention of hydrogen

sulfide poisoning and methods of purification of the atmosphere and wastewater from hydrogen sulfide.

Research methods. The main principle of the study is to assess the content of hydrogen sulfide in the natural environment and the level of morbidity and mortality in the city of Atyrau.

The author applied the following methods: an automated system for monitoring emissions into the environment based on the results of analysis and processing of air samples taken at stationary or mobile observation posts equipped with air sampling equipment and automatic gas analyzers for continuous determination of concentrations of harmful impurities; soil samples were taken and the content of mobile sulfur was determined by photoelectrocolorimetric method; morbidity data The population was collected, processed and analyzed using medical statistics methods. The analyses were carried out in the testing laboratory of Analytical Laboratory for Environmental Protection LLP. Methods of mathematical statistics, geoinformation technologies, and cartographic modeling were widely used in the processing of materials.

The practical value of the work lies in the fact that the results of the ecotoxicological assessment of pollution of the urban ecosystem with hydrogen sulfide can be applied in a comprehensive assessment of environmental quality targets, in the development of projects to assess the environmental impacts of economic activities, as well as recommendations for those regions where there is atmospheric pollution with hydrogen sulfide from various sources, such as mining and refining of oil and natural gas, emissions from sewage treatment plants and landfills, natural gas production plants, paper mills, manure processing plants, etc.

Implementation of research results.

The conducted experimental studies made it possible to determine the relationship between the content of hydrogen sulfide in the atmosphere and the accumulation of mobile sulfur in the soil, as well as to identify the dependence of the increase in hydrogen sulfide content and the incidence and mortality of diseases of the respiratory and cardiovascular systems of the population of Atyrau. The research data were tested during lectures and practical classes in the disciplines "Environmental Science" and "Geocology" for students of the educational program 6B05201-Applied Ecology at the Kh.Dosmukhamedov Atyrau University and implemented in the LLP "Emba Petroleum Project" in the development of projects on environmental impact assessment.

Scientific statements submitted for protection.

1. data on the content of hydrogen sulfide in the atmosphere of the city of Atyrau for four seasons of the year.
2. data on the content of mobile sulfur in the soil of the city of Atyrau.
3. determination of the correlation between the content of hydrogen sulfide and mobile sulfur in the soil.
4. data on morbidity and mortality of the Atyrau city population.
5. determination of the correlation between the content of hydrogen sulfide in the atmosphere and the mortality rate from diseases of the respiratory system, circulatory diseases and neoplasms.

6. recommendations for the prevention of hydrogen sulfide poisoning and purification of the atmosphere and wastewater from hydrogen sulfide.

The completed dissertation work has a connection with other studies devoted to the ecotoxicological assessment of environmental objects.

The scientific novelty of the work. In connection with the environmental disaster in the city of Atyrau related to air pollution with hydrogen sulfide, the sources of which are the evaporation site "Tukhlaya Balka", located in the left part of the city of Atyrau, located in the right part of the city of Atyrau, a sewage treatment plant located in the settlement of Sary-Ozek, the evaporation site "Kvadrat" at KGP Atyrau oblysy Su Arnasy", as well as the Atyrau oil refinery, there is a need for its environmental assessment. For the first time, an analysis of the hydrogen sulfide content in the city of Atyrau was carried out and the correlation between the hydrogen sulfide content and the content of mobile sulfur and the level of morbidity and mortality of the city's population was determined. Recommendations for the prevention of hydrogen sulfide poisoning and purification of the atmosphere and wastewater from hydrogen sulfide are proposed.

The practical significance of the work. As a result of ecotoxicological studies of the city of Atyrau, it was found that the hydrogen sulfide content in the air of the city of Atyrau varies in different seasons of the year and the maximum contents are noted in the summer. An increase in the content of hydrogen sulfide in the atmosphere leads to an increased content of mobile sulfur in the soil, which in turn increases the acidity of the soil. Increased levels of hydrogen sulfide in the soil contribute to an increase in diseases of the respiratory system and circulatory organs. These studies are of practical importance in the comprehensive assessment of environmental quality targets and in the development of projects to assess the environmental impacts of economic activities

Compliance with the directions of scientific development or government programs. The dissertation corresponds to the priority direction of science development approved by the Higher Scientific and Technical Commission under the Government of the Republic of Kazakhstan in the direction 1. Ecology, environment and rational use of natural resources: V.T. part 6) Research of actual problems of air quality. Its content corresponds to the National Development Plan of the Republic of Kazakhstan until 2025 (2018-2025), as well as the State Program for the Development of Regions (2020-2025).

Personal contribution of the author. The dissertation is the result of research by Ryskalieva D.K. in the period 2021-2024. The author independently set the goal, defined the tasks and plan of the ongoing research of ecotoxicological assessment of pollution of the urban ecosystem with hydrogen sulfide in the city of Atyrau, determination of hydrogen sulfide in the atmosphere, soil sampling, laboratory physico-chemical analyses, experimental and field studies. The analysis and generalization of experimental results of the work with the determination of the correlation between the content of hydrogen sulfide in the atmosphere and the content of sulfur in the soil, as well as its impact on public health, is carried out.

Reliability of the results: The reliability and validity of scientific statements, conclusions and recommendations of the dissertation work are confirmed by the use

of proven modern research methods, processing of the results obtained by methods of mathematical statistics, as well as laboratory tests.

Approbation of the results of the work and publications

The main provisions of the dissertation work were presented at international scientific and practical conferences in Atyrau "Natural Sciences: modern problems and prospects of development" (2021), "Our heart for Independence" (2021), "Youth and Science: today and the future" (2022), in Aktau "Water safety: problems and solutions", dedicated to the 60th anniversary of PhD, Associate Professor Makhambetova R. K., "Scientific modernization: the legacy of personality", dedicated to the 95th anniversary of Academician Sh. Yesenov (2022) and in the proceedings of the AIP Conference Proceedings.

In the period from June 01 to June 26, 2023, she completed a scientific internship at the National University of Uzbekistan named after Mirzo Ulukbek. Tashkent, Uzbekistan, Certificate (Appendix A).

The main provisions of the dissertation work have been published in 11 scientific papers, including 2 articles published in journals included in the Scopus database, 3 articles recommended by the Committee for Quality Assurance in the fields of science and higher Education, CQAFSHE:

- International Journal of Sustainable Development and Planning, 2022. - 17(6);
- International Journal of Sustainable Development and Planning, 2023. - 18(7);
- News of the National Academy of Sciences of the Republic of Kazakhstan. Series of Geology and Technical Sciences. – 2024. – 1 (463);
- Bulletin of the Kazakh National University. The series is ecological. 2022. - 3 (72).

Scope and structure of the work

The dissertation consists of an introduction, the main part, including a literature review, materials and methods, and the results of his own research, a conclusion, a list of references, including 90 sources, appendices. The work contains 164 pages of computer text, 56 figures, 24 tables.

The dissertation work was performed at the Department of Ecology and Geology of the Sh. Yessenov Caspian State University of Technology and Engineering.