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AIR QUALITY AND HUMAN HEALTH: ENVIRONMENTAL PROBLEMS AND SOLUTIONS IN UZBEKISTAN

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Abstract:
The article is devoted to a deep analysis of air pollution, its impact on human health and environmental consequences. The problem of air pollution on a global and Uzbek scale, its main sources (industry, motor transport, natural factors), health consequences (respiratory, cardiovascular diseases, oncological diseases) and solutions are studied. Modern monitoring systems and environmental strategies for improving air quality in industrial regions of Uzbekistan are proposed. The study is based on modern scientific literature, and also pays attention to the economic and social aspects of the problem.

Keywords: atmosphere, air pollution, human health, environmental problem, industry, motor transport, acid rain, greenhouse effect.

Introduction

Atmospheric air is the main resource that supports life in the biosphere, acting as a source of oxygen, protecting against cosmic rays and maintaining the thermal balance of the planet. Over the past two centuries, the industrial revolution, urbanization and the growth of transport have led to a global deterioration in atmospheric quality. According to the World Health Organization (WHO), 91% of the world's population breathes polluted air, which leads to the death of 7 million people every year. In Uzbekistan, in particular, in such industrially developed cities as Tashkent, Fergana and Almalyk, air pollution is a pressing problem not only as an environmental but also as a socio-economic problem. The purpose of the article

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is to analyze the sources of air pollution, assess its impact on health and propose innovative solutions to solve the problem in the context of Uzbekistan [7,10].

The objective of the study: to identify sources of air pollution in Uzbekistan, assess its impact on human health and propose innovative solutions to mitigate the problem.

Research methodology: the study is based on the methods of analyzing scientific literature, synthesizing statistical data and comparing environmental reports of Uzbekistan. WHO, UNEP and local sources are integrated to highlight the problem in a global and local context [1,2,9].

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Sources of air pollution

Air pollution is divided into natural and anthropogenic sources. Natural sources include volcanic eruptions, forest fires, dust and cosmic dust, but their share in global pollution does not exceed 25%. Anthropogenic sources, in particular industry, transport and agricultural activities, account for 75% of air pollution. Globally, vehicle emissions account for 40% of air pollution, the energy industry - 20%, agriculture - 26%. In Uzbekistan, vehicle emissions, in particular carbon monoxide (CO), nitrogen oxides (NOx) and sulfur dioxide (SO2), are the main factors in air pollution in cities such as Tashkent and Fergana. Metallurgical and chemical plants in the cities of Almalyk and Navoi emit heavy metals and toxic gases that harm the local ecosystem [3,7,8].

- Impact on human health

Air pollution affects the human body both directly (through the respiratory tract) and indirectly (through climate change). Carbon monoxide (CO) reduces the oxygen capacity of the blood, increasing the risk of cardiovascular diseases by 2-3 times. Sulfur dioxide (SO2) and nitrogen oxides (NOx) cause respiratory diseases such as bronchial asthma, chronic bronchitis and pulmonary emphysema. In the cities of Chirchik and Almalyk in Uzbekistan, when the concentration of SO2 reached 500-750 μg / m³, respiratory diseases increased by 30%. Carcinogens such as benz(a)pyrene and lead cause lung and skin cancer. The child mortality rate has increased by 1.5 times due to emissions from the aluminum plant in the

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Surkhandarya region. Children's bodies are especially sensitive to polluted air, and they have a high risk of decreased immunity and birth defects [4,7,18].

- Situation in Uzbekistan

Uzbekistan's climate conditions (hot and dry climate) and the location of cities in the foothills are factors that increase air pollution. More than 2,600 enterprises in the republic emit 1.8 million tons of harmful substances into the atmosphere per year, 87% of which are in the Tashkent, Kashkadarya, Fergana and Navoi regions. The Mubarek Gas Processing Plant and the Almalyk Metallurgical Plant account for 65% of emissions. As a result of the drying up of the Aral Sea, salt dust emissions in Karakalpakstan and Khorezm have led to a 20% increase in respiratory diseases. According to data for 2023, the per capita air pollution rate in Tashkent is 85 kg, which is slightly lower than the 90.1 kg in 2001, but remains at a dangerous level. Air quality monitoring is only available in large cities, making it difficult to identify the problem in rural areas [3,10,15].

- Environmental impacts

Air pollution causes serious damage to ecosystems. Sulfur and nitrogen oxides form acid rain, which destroys vegetation in the Chatkal Nature Reserve in the Almalyk-Akhangaron region of Uzbekistan. Acid rain reduces soil fertility by 15% and acidifies water bodies. CFCs and chlorofluorocarbons have depleted the ozone layer in the stratosphere and increased ultraviolet radiation by 10%, which increases the incidence of skin cancer. Carbon dioxide (CO2), methane (CH4) and nitrogen oxides (N2O) enhance the greenhouse effect, leading to desertification and depletion of water resources in Uzbekistan. Reports for 2023 show that extreme weather events in the country have increased by 30% due to climate change [2,13,19].

Air pollution has economic and social consequences. According to WHO, global health costs due to air pollution amount to $4.6 trillion per year. The annual cost of treating respiratory diseases in Uzbekistan was 500 million soums in 2023. Due to polluted air, labor productivity decreases by 10%, which hinders economic growth. In social terms, air pollution increases population migration, in particular, in Karakalpakstan, local residents move to other regions due to salt dust. The issue of climate justice is also relevant, and the impact of air pollution is felt more strongly by the poor [5,6,17].

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- Solutions

Comprehensive measures are needed to reduce air pollution. In the conditions of Uzbekistan, the following solutions are proposed:

Industrial modernization: Increasing the efficiency of dust and gas cleaning devices to 90%. 77% of current devices are outdated, by 2025 it is planned to update 50%.

Alternative energy: Expansion of solar and wind energy projects. Solar power plants in the Navoi region can reduce CO2 emissions by 1 million tons per year.

Eco-friendly transport: Increase the number of gas-powered and electric vehicles by 20%. Tashkent plans to increase the fleet of electric buses to 500 by 2025.

Green Zones: Expand green belts in cities by 30%. In 2023, 10,000 trees were planted in Tashkent, improving air quality by 5%.

Monitoring with Artificial Intelligence: Implement AI systems that monitor air quality in real time. These systems identify emission sources with 20% accuracy.

Environmental Education: Inform the population about the dangers of air pollution. In 2023, ecology lessons were introduced in 1,000 schools [18,21,22].

Table 1: Share of air pollution in Uzbekistan by region (2025)

Region	Share (%)	Main sources
Tashkent	30	Automotive industry, industry
Kashkadarya	25	Oil and gas, energy
Fergana	20	Chemistry, metallurgy
Navoi	12	Metallurgy, energy
Other	13	Agriculture, household waste

Conclusion

Air pollution is a serious environmental, health, economic and social problem in Uzbekistan and around the world. Air quality is deteriorating due to industry, transport and natural factors, increasing the risk of respiratory diseases, cancer and climate change. To solve the problem in Uzbekistan, it is necessary to modernize industry, develop green transport and alternative energy, introduce AI monitoring systems and expand environmental education. It is necessary to develop a strategic approach to improving air quality based on international experience and local legislation.

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