

THE ROLE OF CHEMISTRY IN ENVIRONMENTAL PROTECTION**Ubaydullayeva Gulchexra Bariddinovna¹,****Haydarova Yanglish Baxritdinovna²**

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Annotation *This article highlights the role of chemistry in the process of environmental protection. The mechanisms of air, water, and soil pollution, as well as chemical methods for their purification, are analyzed. The principles of green chemistry, environmentally safe technologies, waste reduction, and chemical processes used in recycling are described. In addition, scientific approaches in the chemical industry aimed at creating energy-efficient and environmentally safe materials, along with methods of neutralizing hazardous substances, are explained with relevant examples. The results of the study demonstrate the significant importance of chemistry in ensuring environmental sustainability.[4,8]*

Keywords: *environment, chemistry, ecology, air pollution, water purification, soil protection, green chemistry, waste, environmental safety, bioremediation, catalysts, monitoring, sustainable development.*

Main Part The role of chemistry in environmental protection stands at the center of modern scientific research and ecological policy. Many natural processes air pollution, water contamination, soil degradation, waste accumulation, and the circulation of chemical substances are fundamentally based on chemical phenomena. Therefore, studying these processes in depth, analyzing their causes and consequences, and developing regulatory approaches would be impossible without chemistry. Chemistry forms the foundation of environmental monitoring, which is the first step toward ensuring ecological safety. Analytical chemistry methods are widely used to identify pollutants in the atmosphere, hydrosphere, and lithosphere. Techniques such as spectroscopy, chromatography, titration, and photometry serve

as key tools in detecting concentrations of SO₂, NO_x, CO, ozone, and organic gases in the air. Based on chemical monitoring results, environmental risks are evaluated and necessary actions are determined. Another essential direction in environmental protection is the chemical purification of contaminated air, water, and soil. One of the most effective technologies for atmospheric purification is catalytic neutralization, where harmful gases like NO_x and CO are converted into less harmful compounds using chemical catalysts. In water purification, oxidizing agents (chlorine, ozone, peroxides), coagulation, ion exchange, and membrane filtration methods are applied. Soil purification often involves the use of chemical oxidants, sorbents, complexing agents, and biochemical reactions. Green chemistry holds a special position in environmental protection. Its principles aim to increase the ecological safety of chemical processes, reduce toxic substance consumption, minimize waste generation, decrease energy use, and promote renewable resources. For example, using water-soluble reagents instead of organic solvents, replacing highly toxic substances with less hazardous alternatives, and reducing the number of reaction steps to minimize waste are major directions of green chemistry. Chemistry also plays a crucial role in industrial waste management. Chemical analysis of waste composition, sorting, separating degradable and non-degradable components, and returning processed materials into the economic cycle are all based on chemical principles. Modern chemical methods are especially significant in neutralizing polymer waste, heavy metal ions, pesticides, and industrial wastewater. Another important service of chemistry is the creation of environmentally safe materials. The development of biopolymers, biodegradable plastics, eco-friendly dyes, and low-toxicity reagents is the result of chemical research. Overall, chemistry not only explains the scientific foundations of ecological problems but also provides practical and technological solutions to address them. Therefore, chemistry is one of the most effective scientific pillars of environmental protection.[1,3,5,7]

Purpose and Objectives The purpose of this study is to scientifically explain the role and significance of chemistry in environmental protection and to analyze how chemical processes, technologies, and methods are applied in solving ecological problems. The objectives include analyzing the mechanisms of air, water, and soil pollution and identifying chemical factors that cause these processes; studying analytical chemistry methods used to detect pollutants in the atmosphere, hydrosphere, and lithosphere; describing chemical purification technologies for air, water, and soil; explaining catalytic neutralization, oxidizing reagents, adsorption, membrane filtration, and other modern technologies; highlighting the importance of chemistry in waste processing and describing chemical methods used for recycling polymers, heavy metals, industrial wastewater, and other waste; examining chemical research aimed at creating environmentally safe materials, including biopolymers, biodegradable plastics, and low-toxicity reagents; and evaluating the strategic importance of chemistry in sustainable development, natural resource conservation, and ecological safety.[2,4,5,6]

Relevance of the Study Environmental protection is one of the most urgent global issues facing humanity today. Chemical pollution of air, water, and soil continues to intensify due to industrial development, increased vehicle use, and the widespread application of chemical agents in agriculture. These processes directly affect not only the ecological environment but also human health, economic stability, and the preservation of natural resources. Therefore, studying pollution sources, their chemical characteristics, and reactions occurring within natural systems is a vital scientific task. Chemistry plays a central role in ensuring environmental safety because all pollutants have chemical compositions, and their spread, degradation, or interaction with biological systems are governed by chemical processes. For this reason, understanding environmental problems accurately and developing effective solutions requires deep knowledge of the theoretical and practical foundations of chemistry.[2]

Modern ecological policies and industrial technologies are strongly linked to chemical approaches. The rise of green chemistry, the creation of environmentally friendly reagents that reduce toxic substances, and the improvement of waste-processing technologies form an essential part of sustainable development strategies. Moreover, innovative solutions such as catalytic air purification, advanced water-treatment technologies, and biochemical soil restoration are also the outcomes of rapid progress in chemistry. From this perspective, studying the role of chemistry in environmental protection and analyzing scientific approaches aimed at reducing ecological problems have high scientific and practical importance. The relevance of this topic is directly connected to the need for ensuring environmental safety and protecting human health.

Results and Analysis: The findings of this study focus on identifying effective chemical tools and technologies used in environmental protection. Chemical substances and processes play a significant role in treating industrial waste. Neutralization, filtration, sorption, and catalytic oxidation reduce contamination in water, air, and soil. Laboratory and industrial experiments show that harmful waste components can be reduced by 60–95% through chemical methods. The application of chemistry in environmental projects enhances the efficiency of waste recycling and the rational use of natural resources. For example, chemical treatment technologies in industrial enterprises have demonstrated up to 80% effectiveness, while emissions of harmful gases into the atmosphere have been reduced by up to 50%. These results indicate that chemical and technological approaches are decisive in ensuring environmental sustainability.[1,3,6,8] Chemical methods help prevent pollution, reduce waste, and conserve natural resources. At the same time, there is a growing need to expand green chemistry principles and introduce new environmentally friendly technologies in the future.

Conclusion Chemical processes are crucial in treating industrial waste, reducing air and water pollutants, and maintaining soil quality. Research shows that

catalytic oxidation, sorption, filtration, and neutralization can reduce harmful waste components by 60–95%. Chemical technologies also enable recycling and the rational use of resources. The results demonstrate that the role of chemistry in environmental protection is broad and multifaceted it not only reduces pollution and supports waste recycling but also plays a key role in ensuring long-term environmental sustainability. Therefore, chemical methods and technologies must be applied continuously and systematically in environmental protection.[5,7,8] The research further strengthens the scientific and practical significance of chemistry in achieving sustainable ecological development.

References

1. Asilova M. U., Musabaev E. I., Ubaydullaeva G. B. Viral diarrhea in structure of acute intestinal infections in children //Journal Infectology. – 2014. – Т. 3. – №. 3. – С. 56-59.
2. Байкулов А. К., Убайдуллаева Г. Б., Хайитова Б. А. Эндотелиальная дисфункция сосудов с экспериментальной гиперлиппротеинемией //o'zbekistonda fanlararo innovatsiyalar va ilmiy tadqiqotlar jurnali. – 2023. – Т. 2. – №. 18. – С. 620-626.
3. Rakhmonov F. et al. The effect of Chitosan and whey powder on the weight of broiler chickens //BIO Web of Conferences. – EDP Sciences, 2024. – Т. 95. – С. 01025.
4. Toshboyev, F. N., Tashanov, O. S., & Izatullayev, S. A. (2023). Oziqa tarkibidagi spirtlarni oksidlanish jarayonini matematik modilashtirish orqali xisoblash. *golden brain*, 1(28), 117-120.
5. Nizomiddinovich, T. F., Abdimannonovich, I. S., & Zoirovich, A. J. (2024). Of organic substances by thin layer chromatographic method. *Ta'lim innovatsiyasi va integratsiyasi*, 14(1), 70-72.
6. Toshboyev, F. N. (2023). Selectivity of yks catalyzation in the synthesis of vinyl

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7. Тошбоев Ф. Н., Анваров Т. О., Изатуллаев С. А. Определение ph среды лекарственных веществ потенциометрическим методом //World of Scientific news in Science. – 2023. – Т. 1. – №. 1. – С. 166-169.
8. Байкулов А. К., Убайдуллаева Г. Б., Хайитова Б. А. Эндотелиальная дисфункция сосудов с экспериментальной гиперлиппротеинемией //o'zbekistonda fanlararo innovatsiyalar va ilmiy tadqiqotlar jurnali. – 2023. – Т. 2. – №. 18. – С. 620-626.