



GREEN CHEMISTRY AND ENVIRONMENTAL PROTECTION

Norkulova Marjona Oybek kizi

Termez State University

oybeksalayev23@gmail.com

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ABSTRACT

This article discusses the emergence of green chemistry, its fundamental principles, and its importance in addressing environmental problems. Information is provided on environmental issues caused by the chemical industry and human activities, including air, water, and soil pollution. In addition, the article extensively analyzes the role of green chemistry technologies in reducing waste, saving energy, producing biodegradable materials, and ensuring environmental safety.

Introduction

In the 21st century, environmental problems have become one of the most pressing issues facing humanity. Scientific and technological progress, the growth of industrial enterprises, the increase in transportation, and the excessive use of natural resources have disrupted the balance of nature. Air pollution, global warming, ozone layer depletion, water scarcity, and the increasing accumulation of plastic waste are major concerns for scientists around the world today.

Although the development of the chemical industry has improved human life, it has also contributed to environmental problems in some cases. Toxic gases, industrial waste, and synthetic substances have a negative impact on nature. Therefore, the development of environmentally safe technologies and the protection of the environment are among the most important tasks of our time.

One of the modern scientific fields that serves to address these problems is green chemistry. Green chemistry is a branch of science focused on designing chemical processes and products that are environmentally friendly, safe, and economically efficient.

The Concept and Essence of Green Chemistry

The term "green chemistry" was first introduced into science by the American scientists Paul Anastas and John Warner. According to them, green chemistry is the design of chemical products and processes that reduce or completely eliminate the generation of hazardous substances.

The main objectives of green chemistry are:

- Reducing harmful waste;
- Saving energy;
- Developing safe technologies;

- Using renewable resources;
- Protecting human health.

This field not only protects the environment but also increases economic efficiency. As waste is reduced, production costs decrease and resources are used more effectively.

Main Principles of Green Chemistry

Paul Anastas and John Warner developed 12 principles of green chemistry, which play a significant role in creating environmentally safe technologies. The most important principles include:

1. Prevention of Waste Formation

It is more important to prevent waste generation during chemical processes than to treat or neutralize waste afterward.

2. Designing Safer Chemicals

Chemical products should be safe for both humans and the environment.

3. Reducing Energy Consumption

Using methods that require less energy in technological processes is beneficial both environmentally and economically.

4. Use of Renewable Resources

It is important to use biological raw materials instead of depletable resources such as oil and natural gas.

5. Use of Safer Solvents

Since many organic solvents are toxic and flammable, environmentally safe alternatives should be used.

Environmental Problems and the Chemical Industry

The chemical industry is one of the most important sectors of the economy. However, certain chemical production processes have a negative impact on the environment. Toxic gases released from factories and industrial plants pollute the atmosphere, while wastewater harms living organisms in rivers and lakes.

Plastic waste is also a serious environmental problem. Conventional plastics decompose very slowly in nature and contaminate soil and water bodies. Therefore, significant attention is currently being paid to the development of biodegradable polymers. In addition, excessive use of pesticides and mineral fertilizers leads to a decline in soil fertility and disrupts ecological balance.

The Importance of Green Chemistry in Environmental Protection

Many environmental problems can be reduced through the application of green chemistry technologies. For example:

- Production of biodegradable materials;
- Use of recyclable products;
- Implementation of energy-efficient technologies;
- Reduction of harmful gas emissions.

Today, the use of solar and wind energy is also an important component of green technologies. These energy sources do not release harmful gases into the atmosphere.

Green chemistry is widely applied in the pharmaceutical industry, food industry, agriculture, and cosmetics industry. The demand for environmentally friendly products is increasing every year.

Prospects of Green Chemistry in Uzbekistan

Uzbekistan is also paying great attention to eliminating environmental problems and developing a green economy. In recent years, a number of reforms have been implemented in the fields of waste recycling, the use of environmentally friendly energy sources, and the introduction of water-saving technologies.

The introduction of modern and environmentally safe technologies in the chemical industry can reduce the amount of harmful substances released into the atmosphere and water bodies. This is of great importance for protecting public health and preserving nature.

Conclusion

In conclusion, green chemistry is one of the most important scientific fields for solving environmental problems today. This discipline contributes to waste reduction, energy conservation, rational use of natural resources, and the protection of human health. In the future, the further development of green chemistry technologies can help create an environmentally safe and sustainable society. Therefore, it is important for young specialists and scientists to conduct research in this field and contribute to the development of environmental awareness and culture.