Opportunities And Effectiveness Of Integrating Organic Chemistry Lessons With Environmental Sciences

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Abstract
This article explores the relevance, opportunities, and pedagogical effectiveness of integrating organic chemistry with environmental sciences in general secondary education schools. In particular, it analyzes the potential of designing lessons based on regional sources of organic pollution in Uzbekistan — such as pesticides, mineral and organic fertilizers, industrial waste, and household waste — to foster environmental awareness and responsibility among students. Through this integrated approach, students gain not only knowledge about the composition and properties of chemical substances, but also an understanding of their impact on the environment, ecological safety, and issues related to sustainable development. The article highlights modern teaching methods such as incorporating real ecological situations into lessons, conducting experiments, and using project-based and problem-solving tasks to enhance the effectiveness of instruction.
Keywords: Organic chemistry, environmental education, integration, pesticides, fertilizers, environment, school education, ecological safety, interdisciplinary connection.

Introduction

Nowadays, the intensification of global environmental problems, increasing chemical pollution of the environment, unsustainable use of natural resources, and the growing threats to human health demand the deep integration of the concept of sustainable development into the education system. In particular, the teaching of natural sciences — including organic chemistry — in an ecologically oriented and interdisciplinary manner has become one of the most pressing issues in general education schools [1].

In the Republic of Uzbekistan, the use of pesticides and chemical fertilizers in agriculture, industrial waste, and household pollutants are contributing to the organic contamination of soil, water, and air. From this perspective, enriching the organic chemistry curriculum with content based on local ecological problems can help foster environmental awareness and responsibility among students [2].

This study scientifically and pedagogically explores the opportunities, practical approaches, and effectiveness of integrating organic chemistry lessons with environmental sciences. The main objective is to support the development of not only students' chemical knowledge but also their ecological thinking, analytical reasoning, and conscious attitude toward the environment.

Main Body

The subject of organic chemistry is inherently interconnected with various processes occurring in the environment, and therefore, it must be taught in an integrated manner with environmental sciences. Such integration enhances students' interest in natural sciences, bridges theoretical knowledge with practical life, and helps foster ecological responsibility. Especially in Uzbekistan, with its unique geographical and economic characteristics, the combination of organic chemistry and environmental sciences increases the effectiveness of the educational process.

In lower grades, students are introduced to the basic concepts of substances and their properties. At this stage, it is important to present knowledge about the role of chemical elements and compounds in nature and their interactions with the environment from an

ecological perspective. This way, 7th and 8th-grade students begin to form initial concepts about environmental protection and nature conservation [3-4]

The topic of hydrocarbons studied in the 9th grade is closely related to ecology. Students learn in-depth about the environmental impact of burning alkanes, alkenes, and alkynes — which are used as fuels — and the resulting emission of carbon dioxide and nitrogen oxides. This topic enables students to analyze the environmental effects of industrial facilities and transport systems specific to Uzbekistan, thereby increasing their ecological awareness.

Photochemical reactions involving alkenes and alkynes can lead to the formation of smog and other harmful gases, exacerbating ecological problems. Studying air pollution in urban areas helps students develop the ability to assess environmental conditions critically [5].

In the 10th grade, the study of alcohols, phenols, and organic acids holds significant value for environmental education. Waste generated during the production of alcohols pollutes water bodies. Phenols, often present in industrial waste, negatively affect aquatic ecosystems. Within this context, students have the opportunity to analyze the ecological consequences of industrial pollution in major water sources like the Amu Darya and Syr Darya rivers.

Organic acids and their effects on human health can be linked to toxicology in biology, helping students develop skills to protect themselves from harmful chemicals. Thus, interdisciplinary integration enriches the content of the learning process.

In the 11th grade, topics such as polymers, plastics, and rubbers allow for a broader discussion of environmental problems. Synthetic materials are non-biodegradable and accumulate as waste, contributing to soil and water pollution. Therefore, it is essential to encourage students to think about reducing plastic waste and promoting recycling [6].

By studying the impact of plastic waste on the environmental condition of major cities in Uzbekistan, and examining waste management systems and ecological challenges, students better understand real-world issues, thereby enhancing their environmental consciousness.

In lessons on proteins, fats, and carbohydrates, students analyze the environmental issues arising from food production and processing. The impact of artificial additives, preservatives, and other substances on human health is studied in conjunction with biology [7].

Knowledge from biology about soil and its biocenosis links directly with the chemistry topics of fertilizers and pesticides. Improper use of pesticides and chemical fertilizers can lead to soil and water contamination, disrupting ecosystems. Students evaluate these processes and learn about measures to ensure ecological safety.

Connections with geography allow students to explore Uzbekistan’s natural resources and the environmental consequences of oil and gas extraction. This interdisciplinary approach gives students a broader understanding of the country’s ecological situation.

In natural science blocks, project-based work related to “Environmental Protection,” “Sustainable Development,” and “Climate Change” develops students' ability to identify ecological problems and find solutions.

Conclusion

During lessons, students not only acquire scientific knowledge but also develop environmental culture and a healthy lifestyle. This helps shape them into responsible and environmentally conscious individuals.

As a result, integrating organic chemistry with environmental sciences increases students’ interest in science, promotes analytical thinking, and raises ecological responsibility. It supports their ability to adhere to the principles of sustainable development in real life.

This approach demonstrates itself as an effective method of interdisciplinary integration in school education and reinforces students’ knowledge and skills related to environmental protection. Therefore, integrating organic chemistry lessons with environmental science should be widely implemented in schools.

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