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IMPROVING THE TEACHING OF THE "HYDROGEN CHLORIDE" TOPIC TO GRADE 8 STUDENTS BASED ON THE SUSTAINABLE DEVELOPMENT APPROACH

Urazbaeva Gulnoza Zakhirovna
Doctoral student of Urgench State Pedagogical Institute, uzguli50@gmail.com
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Abstract: This article examines the improvement of teaching the topic "Hydrogen Chloride" to 8th-grade students based on the sustainable development approach. It analyzes the methodological possibilities of integrating the physical and chemical properties, preparation, applications, and safe handling of hydrogen chloride with environmental safety, the rational use of natural resources, and the Sustainable Development Goals (SDGs). Furthermore, the study proposes methods for developing students' chemical knowledge alongside their environmental awareness, chemical safety culture, and responsible attitudes through the use of problem-based situations, real-life tasks, and laboratory activities. The findings demonstrate that applying the sustainable development approach enhances the effectiveness of chemistry education and contributes to the development of students' sustainable development competencies.

Keywords: sustainable development, Sustainable Development Goals (SDGs), chemistry education, Grade 8, hydrogen chloride, environmental education, chemical safety, competency-based approach, problem-based learning, laboratory experiment, environmental awareness, rational use of natural resources, teaching methodology.

Introduction

One of the priority directions in the modern education system is to develop students' scientific knowledge alongside competencies related to environmental awareness, responsible consumption, the rational use of natural resources, and healthy lifestyles. Therefore, the integration of the principles of Education for Sustainable Development (ESD) into chemistry teaching is recognized as one of the key priorities of contemporary education.

Chemistry not only provides a scientific understanding of the processes occurring in nature but also enables students to evaluate the substances used in industry and everyday life, as well as their effects on human health and the environment. In particular, the topic "Hydrogen Chloride", taught in the Grade 8 chemistry curriculum, equips students with essential knowledge about acid formation, the physical and chemical properties of substances, industrial production methods, safe storage, and proper handling of chemicals. Integrating theoretical knowledge of this topic with issues such as environmental safety, the environmental impact of chemical production, and the rational use of natural resources broadens students' scientific outlook and enhances their understanding of sustainable development.

Although the current secondary school chemistry textbooks provide information on the structure, preparation, physical and chemical properties, and applications of hydrogen chloride, methodological recommendations for teaching this topic based on the sustainable development approach remain insufficiently developed. Consequently, students have limited opportunities to relate their chemical knowledge to real-life environmental and social issues, analyze problem-based situations, and draw scientifically grounded conclusions [1].

In this regard, improving the methodology for teaching the topic "Hydrogen Chloride" through the sustainable development approach has become an important scientific and methodological issue. Such an approach contributes to the development of students' environmental awareness, chemical safety culture, critical thinking skills, and the ability to make responsible decisions.

The purpose of this study is to analyze the methodological opportunities for teaching the topic "Hydrogen Chloride" to Grade 8 students through the sustainable development approach and to develop teaching methods and practical recommendations aimed at improving the effectiveness of instruction on this topic.

Main Part

In the Grade 8 chemistry curriculum, the topic "Hydrogen Chloride" is studied as one of the most important compounds of nonmetals. The textbook covers the chemical formula of hydrogen chloride, its molecular structure, laboratory and industrial methods of preparation, its physical and chemical properties, its high solubility in water, and its practical applications. This knowledge helps students develop a theoretical understanding of the composition and properties of chemical substances. However, according to the requirements of modern education, this topic should be taught not only from a theoretical perspective but also through the sustainable development approach.

Within the sustainable development approach, knowledge of chemical substances is studied in relation to their environmental, economic, and social significance. From this perspective, when teaching the industrial production of hydrogen chloride, students' attention should be directed toward the consequences of releasing gaseous substances into the atmosphere, gas purification technologies used in industrial enterprises, and issues related to environmental safety. This approach develops students' ability to evaluate the environmental impacts of industrial processes [2].

The textbook describes the laboratory preparation of hydrogen chloride by reacting sodium chloride with concentrated sulfuric acid. When studying this experiment, particular attention should be paid to laboratory safety regulations. Hydrogen chloride is a toxic gas with a pungent odor that has harmful effects on the respiratory system. Therefore, during laboratory activities, students should be instructed to use a fume hood, wear appropriate personal protective equipment, and dissolve the generated gas in water instead of releasing it into the atmosphere. These practices contribute to the development of students' chemical safety culture and environmental responsibility.

The section on the industrial production of hydrogen chloride also offers significant didactic opportunities from the perspective of sustainable development. In addition to explaining the production of hydrogen chloride through the reaction between hydrogen and chlorine gases, students should be introduced to energy-efficient technologies, gas recycling methods, and waste reduction practices employed in modern chemical industries. This enables students to recognize the importance of the rational use of resources and maintaining environmental balance in the chemical industry.

When studying the physical properties of hydrogen chloride, its high solubility in water can be demonstrated experimentally. Based on this experiment, students may be encouraged to discuss problem-based questions such as: "Why does hydrogen chloride form an acid when dissolved in water?" and "What role do industrial gas emissions play in the formation of acid rain?" Such questions promote students' critical thinking skills and help them relate chemical processes to real-world environmental issues.

The organization of lessons based on the sustainable development approach also requires the use of real-life, problem-based learning activities. For example, students may be asked to analyze the environmental consequences of hydrogen chloride gas emissions from a chemical plant, propose environmentally friendly solutions to reduce these emissions, or develop safe methods for neutralizing hydrogen chloride gas produced during laboratory experiments. Such practical tasks enhance students' problem-solving abilities, scientific decision-making skills, and environmental responsibility.

Furthermore, it is recommended that the teaching of this topic be integrated with the United Nations Sustainable Development Goals (SDGs). In particular, problem-based situations and practical activities related to SDG 3 – Good Health and Well-being, SDG 6 – Clean Water and Sanitation, SDG 12 – Responsible Consumption and Production, and SDG 13 – Climate Action enrich the content of the lesson. As a result, students not only acquire knowledge of the chemical properties of hydrogen chloride but also develop a deeper understanding of its implications for human health, industrial production, and environmental protection [3].

In conclusion, teaching the topic "Hydrogen Chloride" through the sustainable development approach not only strengthens students' chemical knowledge but also promotes the development of environmental awareness, safe chemical practices, a culture of the rational use of natural resources, and the key competencies required for the twenty-first century.

Conclusion

The findings of this study demonstrate that teaching the topic "Hydrogen Chloride" in the Grade 8 chemistry curriculum through the sustainable development approach not only deepens students' chemical knowledge but also contributes to the development of their environmental awareness, chemical safety culture, critical thinking skills, and responsible decision-making competencies. Integrating knowledge related to the preparation, physical and chemical properties, and applications of hydrogen chloride with issues of environmental safety, environmental protection, and the rational use of natural resources enriches the content of the lesson and enhances its practical significance.

Furthermore, incorporating problem-based situations, real-life tasks, laboratory experiments, and activities related to the Sustainable Development Goals (SDGs) into the teaching process enables students to connect theoretical knowledge with practical applications, develop independent thinking, and foster environmental responsibility. Such an approach serves as an important means of increasing students' interest in chemistry, promoting meaningful learning, and improving their ability to apply scientific knowledge in everyday life.

Therefore, improving the teaching of the topic "Hydrogen Chloride" through the sustainable development approach can be regarded as an effective methodological strategy for enhancing the quality of chemistry education, fostering students' environmental awareness and sustainable development competencies, and achieving the fundamental objectives of contemporary education.

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