

**ALTERNATIVE AND RENEWABLE FUELS (BIOFUELS, HYDROGEN, ETC.)
IN SCHOOL CHEMISTRY: AN ECOLOGICAL CONTEXT-BASED APPROACH***Mammadzade G. M.*, Babayeva N. Y.Azerbaijan State Pedagogical University, Baku, Azerbaijan
gul_mamedova14@mail.ru

The growing global demand for sustainable energy solutions necessitates the integration of environmental education into science curricula. This study explores the methodological foundations for presenting alternative and renewable fuels—such as biofuels and hydrogen—within school chemistry through an ecological context-based approach. The paper emphasizes how chemical concepts related to combustion, energy changes, oxidation–reduction reactions, and environmental impact can be taught using real-world sustainability issues. A model for integrating renewable fuel topics into secondary chemistry lessons is proposed, linking theoretical knowledge with ecological awareness and responsible decision-making. The approach enhances students' scientific literacy, systems thinking, and understanding of green chemistry principles. The findings suggest that contextualized instruction improves conceptual understanding while fostering environmental responsibility.

Modern education must address global environmental challenges, including climate change, fossil fuel depletion, and carbon emissions. Chemistry education plays a crucial role in forming environmentally literate citizens capable of understanding energy transformations and sustainable technologies. Therefore, integrating renewable fuels into the school chemistry curriculum is both scientifically and socially relevant. The aim of this study is to develop a methodological framework for teaching alternative and renewable fuels in secondary school chemistry through an ecological and sustainability-oriented context. The research is based on theoretical analysis of chemistry curricula, pedagogical literature review, and the design of context-based lesson models. Inquiry-based learning, problem-oriented discussion, and interdisciplinary integration strategies are applied.

The novelty of the study lies in combining renewable energy chemistry topics with ecological education through a structured didactic model that connects chemical theory (combustion reactions, calorific value, redox processes) with real environmental problems and sustainable development goals. The proposed model can be applied in Grade 9–11 chemistry lessons when teaching hydrocarbons, oxidation–reduction reactions, thermochemistry, and environmental chemistry. It provides teachers with structured lesson strategies, discussion questions, and project-based activities focused on bioethanol production, biodiesel synthesis, and hydrogen fuel cells.

Integrating alternative and renewable fuels into school chemistry within an ecological framework enhances students' understanding of energy transformations and connects chemical theory to real environmental challenges. By linking topics such as biofuels and hydrogen energy to issues like climate change and sustainability, chemistry becomes more meaningful and socially relevant. This context-based approach strengthens critical thinking, scientific reasoning, and systems thinking, while increasing student motivation and engagement. It also promotes environmental responsibility by encouraging learners to evaluate the advantages and limitations of different energy sources. Overall, embedding renewable energy topics into chemistry education supports both conceptual understanding and sustainable thinking, making the subject more aligned with contemporary global needs.