Teaching Case Design with Ideological-Political Elementof Reactions of Alkanes in College Chemistry (II)

ABSTRACT

College chemistry (II) is a basic course for normal college students majoring in science education in our university, and it is of practical significance to integrate ideological and political education into the teaching of the course to achieve the teaching purpose effectively. Taking the part “reactions of alkanes” as a case of teaching design, this paper discussed the teaching design ideas and methods of integrating ideological-political elements into the specialized course specifically in the setting of the three learning objectives, the introduction of the new lesson, the teaching of the three knowledge points, etc., and carried on the teaching reflection. By fully excavating the ideological-political elements in this course, and integrating the ideological and political education with cases related to reactions of alkanes in daily life and production practice into, it can arouse the students' attention and thinking, stimulate the students' interest in learning, and enhance the effectiveness of students' learning.

Keywords:ideological-political element; organic chemistry; alkane; chemical reaction; teaching design.

1. INTRODUCTION

The undergraduate education is the most important four years to establish students' world view, life view and scientific view, and the course with ideological-political element is the same direction proceeding of all kinds of courses with ideological and political theory courses to form a synergistic effect, it guides the students to form the correct three views imperceptibly in the process of acquiring knowledge and developing ability, and show the proper meaning of talent cultivation.

Course with ideological-political element is a practical exploration of integrating ideological and political education into classroom teaching, and it is a hot word of the current curriculum reform in higher education. Strengthening the construction of courses with ideological-political elements is also the direction of the correct operation of running a university. In the “guideline for the construction of ideological and political education in colleges and universities” issued by the Ministry of Education of China in June 2020 and the “work program for comprehensively promoting the construction of great ideological and political education” issued in July 2022, it is emphasized that the ideological and political education is a kind of comprehensive education, which takes “building morality and cultivating people” as the fundamental task of education [1, 2].

College chemistry (II) is an important professional foundation course in the talent cultivation program of science education major of Zhejiang Foreign Language Institute, which mainly studies the content of organic chemistry, so that students can master the preparation,

structure, properties and application of organic compounds, laying a good foundation for students to learn the following professional courses as well as to be qualified for teaching junior high school science course and conducting scientific research in the future.

The knowledge system of organic chemistry contains abundant ideological-political elements, the related laws of scientific knowledge, the extended profound philosophical thoughts and the organic chemists' noble moral sentiments in the course can lead the students to set up a correct and positive view on the world, life and values.Chemistry is closely related to our daily life, especially the organic chemistry is closely related to our food, clothing, housing and transportation. If we combine our daily life and use this as a carrier to develop ideological and political education, we can not only enliven the atmosphere of classroom, stimulate the enthusiasm of students, but also enable students to learn professional knowledge at the same time, the moral quality is also a greater improvement.

Most of the published studies on the ideological and political education in organic chemistry content focus on describing the educational elements of the course and its entry points and implementation paths in the course teaching [3-8], while studies on each step of teaching design with ideological-political element are relatively rare to see published, even published cases are also focused on the organic chemist's rigorous scientific serious work attitude, noble moral sentiments and so on [9-11].In this paper, the fourth section of chapter two alkanes, reactions of alkanes, was selected as a case study of teaching design of course with ideological-political element, specifically discussed how to integrate professional courses with ideological and political contents in each step of teaching design.

2. PRE-TEACHING ANALYSIS

Alkanes, the object of this lesson, are the first class of specific organic compounds involved in the course. They are also the simplest organic compounds in structure and chemical property, the content of the textbook is simple, but it is not so easy to teach well.

Alkanes are the basis of organic compounds, and through in-depth understanding of their chemical properties, students can better understand the basic principles of organic chemistry. Moreover, this part of the content is closely related to production and life practice, with strong applicability and practicability, which is conducive to stimulate students' interest in learning and desire for knowledge. At the same time, it also has a certain degree of theory, which is beneficial to inspire students' scientific thinking and cultivate the ability of comprehensive analysis.

This requires teachers not only to impart professional knowledge, but also to make students realize the necessity of learning organic chemistry and be able to use their knowledge of organic chemistry to solve practical problems. It is also important to raise students' awareness of the organic world and develop their ability to study organic chemistry.On this basis, if the ideological-political elements of the course can be integrated, so that students can learn professional knowledge, but also improve the comprehensive quality, only thus this lesson can be considered a good one.

3.LEARNING OBJECTIVES SETTING

The objectives of this lesson are mainly reflected in the three aspects of knowledge objectives, ability objectives and literacy objectives.

3.1 Knowledge objectives

The knowledge objectives of this lesson are specifically as follows:

(1) Understand the combustion, pyrolysis and halogenation reaction of alkanes.

(2) Understand the mechanism of free radical substitution reaction and be able to predict the phenomena and results of alkane halogenation reaction.

(3) Be able to list the important applications of alkane reactions in social life and production.

3.2 Ability objectives

The ability objectives of this lesson are specifically as follows:

(1) Be able to comprehensively analyze the chemical reactions of alkanes, to develop profoundness and flexibility of thinking, and to cultivate the ability of divergent thinking and dialectical thinking.

(2) Be able to use professional knowledge to analyze and solve problems related to the chemical properties of alkanes in daily life and production activities.

3.3Literacy objectives

The literacy objectives of this lesson are specifically as follows:

(1) Know the safe use of natural gas and develop safety awareness.

(2) Know torch fuel, combustible ice, greenhouse gases and carbon emissions, and enhance a sense of responsibility for protecting the environment and promoting sustainable development.

(3) Know gasoline label number and petroleum products, inspire interest, stimulate the love for the major.

4. TEACHING METHODOLOGY ELABORATION

This lesson is taught using multimedia as the main method and blackboard writing as the supplementary method.

Through the self-built course “college chemistry (II)” on the “Superstar” on-line studying platform, the learning space is expanded, students can preview before class and review after class. In the classroom, thinking is inspired by realistic problems, classroom teaching is combined with students' life experience. The knowledge of chemical reactions of alkanes are explained by comprehensive analysis and comparison methods, and related reactions are discussed from multiple angles to develop students' profound and flexible thinking.

5. TEACHING CONTENT DESIGN

Teaching content of this lesson mainly focus on three knowledge points: (1) Combustion of alkanes (Fig.1); (2) Pyrolysis of alkanes (Fig.2); (3) Halogenation reaction of alkanes.

Fig.1. Combustion of alkanes (Pictures from the web)

Fig.2. Pyrolysis of alkanes (Pictures from the web)

5.1 New lesson lead-in

The integration of the ideological and political education objectives of this lesson is mainly reflected in the cases related to alkane reaction in daily life and production practice, so we adopt the situational teaching method and select two familiar life scenes, (1) using gas, (2) refueling a car, as the situational material to lead in. This will stimulate students' interest in learning, guide students to realize that organic substances can be found everywhere around them, understand the close connection between organic chemistry and life, and make students more deeply realize the importance and application value of organic chemistry to real life, which will ultimately feed back into the classroom knowledge learning.

5.2The first knowledge point: Combustion of Alkanes

The teaching design idea is: Through the analysis of combustion products, to guide students to analyze the problem from multiple perspectives, to discuss the environmental problems

that may be involved in the use and mining of alkanes, to guide students to think about the role of organic chemistry in environmental protection, to improve students' ability of learning and analysis, and to inspire scientific thinking. At the same time, to cultivate students' consciousness of safety, environmental protection and sustainable development.

The teaching of this knowledge point is related to the first scene above, using gas, to carry out a comprehensive analysis of the combustion equations. The integration of ideological-political elements with the teaching content is embodied in the following: Combining the teaching content of combustion of alkanes, through the specific case of “safe use of natural gas” to cultivate students' safety awareness; through the cases of “torch fuel and carbon emission” and “combustible ice and greenhouse gases” to cultivate students' sense of responsibility to protect the environment and promote sustainable development; through the comprehensive analysis of combustion equations to cultivate students' dispersive thinking ability of observing well and learning from others.

For example, about the complete combustion of alkanes generating CO_2, it can be taught that the torch fuel of the modern Olympic Games used is usually propane, which is inexpensive and easy to liquefy at room temperature under pressure, making it easy to store in the torch, combustion only forms water vapor and carbon dioxide, belonging to the clean fuels, in line with the concept of “Green Olympics”. At the same time, the flame color of propane gas combustion is bright yellow, such color makes it easy to identify and use for TV broadcasting, news photography needs, which also makes propane become the first choice of many Olympic torch fuel. However, unlike the 2008 Beijing Olympic Games where propane was used as the torch fuel, the 2022 Beijing Winter Olympic Games used hydrogen as the torch fuel for the first time. Hydrogen produces only water when burned, and does not produce carbon dioxide, thus can achieve zero carbon emission, which truly embodies the principles of green, environmental protection and sustainability.

5.3The second knowledge point: Pyrolysis of alkanes

The teaching design idea is: To let students feel the practical application of alkane reactions, to guide students to think about the importance of alkanes in society and industry, to stimulate curiosity, and to be able to connect theoretical knowledge with practical applications.

The teaching of this knowledge point is related to the second scene above, refueling a car, to analyze in the context of petroleum refining, pyrolysis, reforming, gasoline octane number and gasoline label number, etc. The integration of ideological-political elements with the teaching content is embodied in the following: Combining the teaching content of pyrolysis of alkanes, through the case of “gasoline label number and gasoline octane number”, students form the concept that “organic chemistry originates from life and serves the society”, and develop the consciousness of applying the relevant knowledge and methods learned to analyze and solve practical problems, and the ability of utilizing the relevant knowledge learned to arrange daily life correctly and healthily.

For example, in the eyes of many people, the perception of petroleum is gasoline, diesel, petroleum energy has nothing to do with them if that they do not use gasoline and diesel. In fact, the derivatives of petroleum are very rich, gasoline and diesel fuel are only two of them, a lot of cosmetics, chemical preservatives, sunscreen are all applications of petroleum products. Gasoline, on the other hand, is a mixture that burns in the internal combustion engine causing knock or detonation, which will reduce the power of the engine and will damage the engine. 92, 95, 98 and other gasoline label number represents its anti-knock,

that is, gasoline in the engine is a quiet combustion or not, the combustion quiet to what extent, expressed by the octane number of gasoline.

5.4The third knowledge point: Halogenation reaction of alkanes

Teaching design idea is: Students should think the problem from a dialectical point of view, to develop students' dialectical thinking ability as well as the ability to think from the typical to the general.

The teaching of this knowledge point elaborates the mechanism of free radical reaction and the reactivity of different kinds of H in the structure of alkanes through the monochlorination reaction of methane. The integration of ideological-political elements with the teaching content is embodied in the following: Combining with the teaching content of halogenation reaction of alkanes, through the analysis of the mechanism of the chlorination reaction of methane, the students' dialectical thinking ability and knowledge transfer ability are cultivated.

For example, students can be told that the reaction mechanisms are based on hypotheses, it will be overturned and corrected. Karl Popper (1902-1994), the founder of critical rationalism, once said, “If you believe that a theory is the only possible theory, it shows that you do not understand either the theory or the problem it is trying to solve.” Science requires a critical spirit, respect for experimental facts without blind obedience to authority, and perseverance. Through the study of free radical reaction mechanism of alkane halogenation, a basic learning attitude and values for the subsequent comparative study of the electrophilic addition of alkenes, the nucleophilic substitution of halogenated hydrocarbons, the electrophilic substitution of benzene and the nucleophilic addition of aldehydes and ketones are established. Through the study of the structure, properties and reaction law of alkanes, the students can understand the dialectical relationship that the structure determines the property, and the property reflects the structure.

6. TEACHING REFLECTION

In this lesson, we integrate ideological-political elements with cases related to alkane reactions in daily life and production practice. Combined with daily life, the common nouns are corresponding to the concrete examples of alkane reactions in the classroom, which arouses students' attention, thinking and stimulates their interest in learning.

The integration of ideological-political elements in this lesson increases the interest of knowledge, so that students can study for the sake of application, and improve the enthusiasm to learn this course. When preparing for the lesson, teachers should consider the presentation form of the ideological and political materials and the timing of ideological and political education, and grasp the time and make a coordinated plan in advance.At the same time, we guide students to carry out on-line course with ideological and political learning with the help of the expansion materials of the self-built course on the “Superstar” platform, which can be used to supplement the classroom content and summarize the course to enhance the learning effect of the students.

In addition, the content of this lesson is simple and easy to understand, but it can also be guided by academic research in future teaching. For example, looking up the latest research progress in alkanes, which can make this course more thoughtful, and at the same time, enhance the students' ability of information retrieval and comprehensive analysis, and cultivate the students' independent thinking and innovative consciousness in the field of organic chemistry.

7.CONCLUSION

The focus and keynoteof ideological and political education in class is still the course, the course bears ideological and political load. The above teaching cases of the integration of professional knowledge and course with ideological-political element in the part of reactions of alkanes have achieved good teaching results in the actual teaching process. Through the guidance of teachers' course with ideological-political element, students can not only master the professional knowledge, but also improve the enthusiasm for learning this course, and also improve the professional discipline thought, academic attitude, the pursuit of science, and so on, and form a good mental outlook.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Authors hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

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