

Teaching Design and Discussion of the Experimental Course of "Biogas Production and Utilization Engineering" based on the Ideological and Political Education

Dengchao Jin, Xinyuan Liu *, Jinxing Peng, Nan Wu and Fan Yang

College of Engineering and Technology, Tianjin Agricultural University, Tianjin 300392, China

* Corresponding author: Xinyuan Liu

Abstract: Practice teaching occupied an important position in higher education. The experiment program of "Gas chromatography analysis of fermentation gas composition" included in the course of "Biogas Production and Utilization Engineering" in the major of the new energy science and engineering is used as an example to discuss the teaching reform based on the ideological and political education. Through deep exploration of ideological and political elements of the curriculum, the ideological and political teaching concepts including realistic scientific literacy, rule consciousness and safety production consciousness, engineering ethics and legal consciousness are formed as the main content and are further integrated into the teaching design. The experimental teaching reform serves the talent training goal of the major, which is to cultivate engineering and technical talent with both moral and ability in the relevant fields of new energy.

Keywords: Curriculum Ideology and Politics; Experiment Course; Biogas Production and Utilization Engineering; Teaching Design.

1. Introduction

"Cultivating morality" is the fundamental task of education and the foundation of colleges and universities [1]. Higher education should put the cultivation of talents' "morality" in an important position in education, and truly cultivate talents useful to the country, the society and the people. In order to achieve the new goal of moral education, we should not only strengthen the education of traditional ideological and political courses, but also give full play to the ideological and political role of the "main battlefield" and "main channel" of professional courses, so as to form a long-term mechanism of moral education.

The major of new energy science and engineering is a strategic emerging major facing the field of new energy, with the characteristics of interdisciplinary and innovative integration [2]. "Biogas Preparation and Utilization Engineering" is a compulsory course for the New energy science and engineering major of Tianjin Agricultural University. Its teaching task is to equip students with basic knowledge and skills related to biogas, and cultivate applied engineering and technical talents capable of research, development, design, construction and operation management in the field of biogas. To enable students to form the concept of "green, environmental protection, health, sustainable" ecological cycle agriculture, and have a sense of safety production and scientific innovation spirit. The theory section mainly introduces the basic principle, process technology and engineering operation management of biogas fermentation. The experimental course is an important supplement to the theoretical course and an important teaching link to cultivate students' innovative spirit and practical ability. The verification of theoretical knowledge in practice is helpful to realize the integration of knowledge and promote students to absorb and master the core knowledge

points. Not only that, the biogas fermentation experiment course is also a favorable occasion for the cultivation of students' innovative ability, scientific literacy and safety awareness, which is suitable for the ideological and political construction of the course. Therefore, this paper takes the experimental project of "Gas chromatography Analysis of fermentation gas composition" as an example, discusses the experimental course reform plan of "Biogas preparation and Utilization Engineering" based on curriculum ideology and politics from three perspectives: teaching concept, teaching program design and teaching reflection. Gas chromatograph is a large instrument. Introducing advanced instrumental analysis technology into students' experiments lays a good foundation for expanding students' knowledge system and guiding students' innovation. It is also a reflection of attaching importance to experimental teaching.

2. Ideological and Political Teaching Concepts of Experimental Courses

2.1. Fact-seeking Scientific Literacy

Seeking truth from facts is the basic scientific attitude and accomplishment that college students should have today, and the experimental classroom is a favorable occasion to cultivate students' scientific accomplishment. Biogas component analysis is a routine test index of biogas engineering, and the test results directly affect our judgment on the operation status of anaerobic fermentation reactors. Only by mastering the accurate data, the reactor operation management personnel can understand the real biogas fermentation situation, and make a reasonable reason analysis of the reactor with poor fermentation effect, so as to carry out effective process control measures in time. In the analysis of biogas composition, it is necessary to establish the experimental method scientifically, process the experimental

data qualitatively and quantitatively according to the measured spectrum, and obtain the objective and accurate analysis results. In the course of teaching, students can understand the scientific knowledge of biogas composition analysis, scientific analysis process and method, help students understand the important impact of biogas analysis on biogas engineering, enable students to experience the scientific spirit in explanation, discussion and practical operation, cultivate scientific ability, correct the scientific attitude of seeking truth from facts, and improve scientific awareness.

2.2. Rule Awareness and Safety Awareness

Nowadays college students have strong personal consciousness and weak rule consciousness. The experimental operation and instrument analysis of the analytical laboratory must strictly follow the operating procedures and specifications to avoid safety accidents. Therefore, in the teaching process, it is necessary to guide students to abide by the laboratory rules and regulations, strictly abide by the instrument operation procedures and the use of experimental equipment, and cite typical campus laboratory safety accidents caused by illegal operations, such as the 12.26 explosion accident in the laboratory of Beijing Jiaotong University and the deflagration accident in the laboratory of Nanjing University of Aeronautics and Astronautics.

Biogas is a flammable gas that poses a risk of explosion. In the design, construction and operation management of biogas engineering, relevant norms and standards should be strictly followed, and safety production risks should be considered at all times. Fully understand the combustion characteristics of combustible gas, guide safe production and engineering design, operation management. In the research of biogas in the laboratory, ventilation, fire prevention, explosion prevention and explosion prevention measures should also be taken, and first aid measures should be taken for burns.

2.3. Engineering Ethics and Legal Awareness

The main content of this experiment is the detection and analysis of the gas production composition of the biogas project. The analysis result represents the operation effect of the biogas project and is one of the evaluation indexes of the project operation. In the field of energy and environment, data testing is a routine work, and the test results are an important reference for the process effect, standard emissions and environmental quality evaluation, and an important basis for implementing the main responsibility of environmental protection and measuring the quality of environmental protection projects. In addition to professional ability, engineering students should have the ability to make moral choices among interests, conflicts, moral and utilitarian conflicts, and make correct judgments of ethical values. Moral cultivation requires students to be able to understand great morality, keep public morality, strictly private morality, in the face of interest choice, speak according to facts, keep the original heart, keep the original heart.

In research and learning, data fraud is a typical academic misconduct, and once found, it will end your academic career. In the relevant monitoring work, data falsification may also violate the law. According to the law, key pollutant discharge units shall install automatic monitoring equipment and network with the monitoring equipment of the ecological environment department [3]. A few polluters interfered with the monitoring equipment without authorization, resulting in

serious distortion of the data received by the environmental authorities. Such behavior not only violates engineering ethics, but also violates the Environmental Protection Law, the Air Pollution Prevention Law, the Water Pollution Prevention Law, the Criminal Law and other relevant laws. To illustrate the serious consequences of subjective interference with monitoring data, such as the illegal behavior of a printing and dyeing company. Guide students to scientifically handle experimental data results, abide by the objective reality, do not fabricate and modify data at will, abide by professional ethics and professional norms, avoid academic misconduct and illegal crimes, and be a qualified energy and environment practitioner.

3. Teaching Scheme Design

3.1. Analysis of Teaching Objective and Learning Situation

The knowledge objective of the teaching is to solve the basic composition of the gas chromatograph, understand the working principle of the gas chromatograph, and master the method of analyzing methane content by gas chromatography. The ability goal is to combine the characteristics of engineering disciplines, adhere to the combination of theory and practice, experience the basic ideas and methods of biogas fermentation experiment data detection, and train students to analyze instruments and understand new ideas, new methods and new developments. The knowledge goal, ability goal and ideological and political concept of teaching are organically integrated to achieve "not far-fetched" and "not preachy" [4]. The teaching design scheme is shown in Figure 1. In terms of learning situation, gas chromatograph is a large instrument and equipment, and students have less understanding of relevant knowledge. However, through the study of theoretical knowledge and relevant professional knowledge of this course, students have already had a certain professional foundation, which is helpful for students to understand and absorb the course content. At the same time, students have strong practical learning ability and can quickly master the operation method and operation process. All these are conducive to the achievement of teaching objectives. On the other hand, students are not good at learning the principles of instrumental analysis and data processing methods, and their interest in learning theoretical knowledge is relatively low. Therefore, in the course of teaching, teachers should strengthen the guidance of theoretical knowledge and adopt the teaching method of combining pictures and pictures to improve students' learning interest.

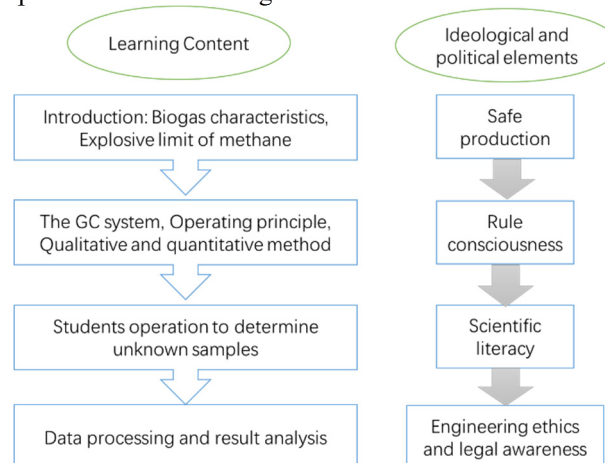


Fig 1. Design of teaching process

3.2. Teaching Method

According to the teaching content and experimental conditions, it adopts the mode of combining explanation method, demonstration method, experiment method and discussion method. The experimental course focuses on training students' practical ability, using the experimental method to let students complete the test of actual samples and the chromatographic analysis of unknown samples. Students are the main body of teaching, and only hands-on practice is more conducive to students' hands-on ability and innovative ability. In order to further increase students' participation, problem-driven teaching method is adopted in discussion [5]. After the analysis of students' knowledge and experience, a number of discussion cases were selected, such as the method

of determining the composition of biogas, its advantages and disadvantages, and how to adjust the state of the instrument in case of overlapping peaks. Through the teaching process of "question raising - teacher guidance - open discussion - teacher summary", the classroom atmosphere is active, students are stimulated to innovate and their learning interests are enhanced. The four methods are combined with each other and interspersed in the teaching process of experimental courses, and efficient and interesting teaching effects are achieved through reasonable teaching design.

3.3. Instructional Design

The specific instructional design process is shown in Table 1.

Table 1. Specific teaching design process

Teaching link	Teaching content
Teaching introduction	Explains: the general composition of biogas, methane explosion limit. Integration of expertise and politics: Safe production of biogas.
Teaching knowledge point 1: The basic composition and working principle of gas chromatography system	Discussion: Method of biogas composition analysis. Explain: Gas chromatography systems and separation principles. Example: Chromatographic separation of pigment. Discussion: Each component is presented in the form of chromatographic peaks in the spectrum. If the chromatographic peaks of two components coincide together, how to adjust the instrument conditions to effectively separate the two chromatographic peaks?
Teaching knowledge point 2: The method of qualitative and quantitative analysis of biogas components	Explanation: The qualitative and quantitative analysis of biogas components. Qualitative analysis: According to the retention time of each component, the peaks were characterized. Quantitative analysis: The standard curve of gas concentration and peak area was established by area calibration normalization method, and the quantitative relationship was obtained by linear regression. Explanation + Operation demonstration: standard curve establishment 1. Start-up of the gas chromatograph (do this at the beginning of the course) 2. six-way valve standard gas injection 3. standard curve spectrum analysis: check the retention time of the peak in the spectrum, characterize the peak, establish the quantitative relationship between the percentage content of each component gas and the peak area, and make the standard curve. Integration of professional knowledge, ideology and politics: rule awareness.
Student experimental operation	Operation exercise: Students determine the methane sample to be tested and obtain the spectrum of the sample to be tested; Record and analyze key data. Integration of professional knowledge, ideology and politics: scientific literacy, compliance with professional ethics and professional norms, legal awareness.
Answer questions and discuss	Question and discussion
Homework	1. Data analysis was carried out to obtain the concentration of each component in the biogas sample. 2. Answer the thinking questions and complete the experiment report.

4. Teaching Reflection

4.1. Deeply Excavate Ideological and Political Materials to Cultivate Engineering Talents with Integrity and Ability

Only by realizing ideological and political guidance can we cultivate talents comprehensively and cultivate talents with correct values. For engineering students, in undergraduate study and practice, they can form a scientific literacy of seeking truth from facts, establish a sense of rules, a sense of engineering safety and a sense of law, and lay a good ideological and moral foundation for future engineering practice and scientific research. To cultivate fully developed new energy engineering and technical talents, it is not only necessary to cultivate students' solid professional foundation

and craftsman spirit, but also to cultivate scientific literacy and noble ideological quality.

4.2. Problem-based Teaching Helps Guide Students to Think Actively

Some open questions are designed to guide students to think and discuss, so that students can deeply integrate into the teaching process, fully participate in and express their views, stimulate the vitality of the class and the atmosphere of classroom innovation, and promote students' absorption of knowledge through objective analysis by teachers.

4.3. Teach by Both Word and Example, to do the Most Effective Education

In teaching, words are important, but example is more convincing. The basic task of cultivating people requires

teachers to have excellent quality. Therefore, teachers should strengthen their own ideological and moral construction, pay attention to the improvement of ability and quality, and use their own words and deeds to infect students and educate students. In this experiment class, the teacher requires the students to improve the awareness of experimental safety, so the teacher himself should have a solid awareness of safety, solid knowledge of safety, more strict requirements in the guidance and operation process, always put safety in the first place. Teachers are responsible for the management of students, at the same time shouldering the safety of students' experiments, teachers' practice and words and deeds are the most effective safety education for students.

5. Summary

Taking the experimental project "Gas chromatography analysis of fermentation gas composition" as an example, this paper introduces the ideological and political construction reform of the experimental course "Biogas Preparation and Utilization Engineering". Ideological and political education reform revolves around the goal of cultivating both moral and talented practitioners in the field of new energy, on the basis of professional knowledge teaching and ability training, the focus is on cultivating students' safety awareness, rule awareness, scientific literacy, engineering ethics and legal awareness. The teaching design skillfully combines knowledge elements with ideological and political elements,

and attaches equal importance to teaching by words and deeds in the teaching process to achieve good teaching results.

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