Journal of Education and Practice
ISSN 2222-1735 (Paper) ISSN 2222-288X (Online)
Vol.15, No.9, 2024


# Teaching Reform and Exploration of Comprehensive Experiment of Applied Chemistry in Normal Universities under the Background of "New engineering discipline"

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**Abstract**

The promotion and implementation of the construction of "New engineering discipline" is a strategic action to actively respond to the new round of scientific and technological revolution and industrial change, which can help to promote the teaching reform of colleges and universities in the new era and accelerate the innovation of institutions and mechanisms, as well as to cultivate a new generation of talents with innovative ability. This paper combines the comprehensive chemistry experiment course, analyzes the teaching status quo of the comprehensive experiment of applied chemistry, and explores the teaching mode of the course in terms of the experimental teaching content of the course and the improvement of the assessment system, so as to improve the quality of teaching and cultivate innovative talents in the context of the "New engineering discipline".

**Keywords:** New engineering discipline, Applied Chemistry, Comprehensive Chemistry Experiment, Teaching Reform and Exploration

**DOI**: 10.7176/JEP/15-9-05

**Publication date**: September 30th 2024

In recent years, in order to cultivate innovative talents in the new century and cope with the new round of scientific and technological revolution and industrial change, the strategic action has promoted the emergence and development of the concept of new engineering disciplines. In recent years, the ministry of education has actively pushed forward the construction of new engineering disciplines, and successively formed consensus such as the "Fudan Consensus", "Tianda Action" and "Beijing Guidelines", and introduced a series of policies based on the above consensus, which has pointed out the direction for the cultivation of talents in colleges and universities in the new era [1-3]. However, the new engineering discipline also puts forward new requirements for the cultivation of talents in colleges and specialties. Applied chemistry, as a discipline of chemistry, needs to adjust its own positioning in this context, which cannot be simply classified as a discipline of science or engineering, but should be located in an applied chemistry discipline combining science and technology, and take the cultivation of applied and innovative chemical talents as the starting point [4]. The new engineering discipline is the core content and main hand of the "Excellence in Engineer Education and Training Program" 2.0, which is the new direction of engineering education reform in the new era. The applied chemistry program of our university has successfully declared the "Excellence in Engineer Education and Training Program" 2.0, based on which, the development of the discipline of applied chemistry and the high quality development of talent cultivation of our university will be boosted. Comprehensive experiment of applied chemistry is a compulsory course for students majoring in applied chemistry, and it is also a comprehensive experimental course of chemistry, which contains knowledge of organic chemistry, polymer chemistry, analytical chemistry, inorganic chemistry and other disciplines as well as basic operations in basic chemistry experiments, and it covers the relevant knowledge in different fields such as pharmaceuticals, environment, industry, etc., and its application characteristics are more prominent and of great significance. Therefore, it is of great significance to explore the teaching mode and reform of comprehensive experiments of applied chemistry under the background of " New engineering discipline". This paper takes students majoring in applied chemistry in the school of chemical and environmental engineering as the target, carries out preliminary teaching reform and exploration of comprehensive chemistry experiment, introduces green chemistry, advanced and market application prospect experimental technology into the course teaching, and focuses on cultivating students' practical application

 

ability while cultivating students' basic knowledge and hands-on ability. At the same time, the assessment methods of students are also improved, with a view to cultivating innovative and applied chemistry undergraduates with a certain international perspective.

**Reform of the teaching content of comprehensive experiments in applied chemistry**

The construction of new engineering disciplines advocates the cross-fertilization of knowledge systems, and the selection of teaching contents should pay attention to the combination of classical contents and the cultivation thinking of engineers [5]. Comprehensive experiment of applied chemistry is a comprehensive class of experiment courses, this comprehensive first reflected in the teaching content. This course is offered in the second semester of the junior year, which is a subject opened after the basic chemistry experiment course. At this stage, the students of applied chemistry have already possessed the basic knowledge of organic chemistry, inorganic chemistry and other courses, and the basic operational ability of basic experiments. The comprehensive experiment of applied chemistry helps students to review and summarize their theoretical knowledge and operation ability, and further consolidate their basic operation ability. In the following semester, students will have to take the examination and retake the examination, and many schools will focus on students' experimental operation ability in the examination and retake the examination, and the study of this course will be helpful for students to apply in the examination and retake the examination.

The experimental content of the comprehensive experiments of applied chemistry is selected from a number of comprehensive and highly applied experimental content, such as the extraction of safranin from the yellow dock, inorganic additive flame retardant and other experiments, which can not only exercise the basic ability of the students. At the same time, the teaching content with strong application is introduced into the teaching of comprehensive experimental course of applied chemistry can effectively enhance the social competitiveness of students. For example, the preparation experiment of 8-hydroxyquinoline, which is mainly used as an intermediate of medicine, dyes and pesticides, and can also be used as a complexing agent and extractant for precipitation and separation of metal ions, has a wide range of applications in the field of medicine and industry. In this experiment, the knowledge learned in the organic chemistry course is reviewed, and the comprehensive experimental ability of the students is also cultivated. The preparation of 8-hydroxyquinoline is applied to the classical synthesis method of Skrup method in organic chemistry. Before the class, the part of the synthesis of quinoline by Skrup method was questioned, and based on the learned knowledge, the specific reaction equations based on the raw materials of the experiments were written, and the steps and main points, which were reviewed and explained in the classroom; in the course of the experiment, operations such as reflux, hydrodistillation and recrystallization were carried out to consolidate the knowledge that the students had learned in the basic chemistry experiments, and then the product structures were characterized and analyzed by infrared spectroscopy in order to review the students' learning for the course of instrumental analysis.

The fundamental task of education is to establish morality and nurture people, and the introduction of curriculum Civics in curriculum teaching is a key measure to implement the fundamental task of establishing morality and nurturing people. In the teaching process of comprehensive experiments of applied chemistry, combining with the characteristics of the discipline of applied chemistry, the fundamental task is to establish morality and nurture people, with the experimental syllabus as the gripping hand, to integrate the value shaping, knowledge transmission and ability cultivation [6]. For example, in the preparation experiments of inorganic additive zinc oligohydrated borate as flame retardant, the synthesis of zinc oligohydrated borate is carried out by using water as the solvent, which has the advantages of simple process, easy operation, high purity, recyclable mother liquor, no three-waste pollution, and helps students to cultivate green chemistry. This method has the advantages of simple process, easy operation, high product purity, mother liquor can be recycled without three-waste pollution, which helps students to cultivate the concept of green chemistry, and it is also particularly important to integrate green chemistry into the teaching content in today's increasingly serious environmental pollution. Meanwhile, compared with antimony oxide, a commonly used flame retardant in China, zinc borate with low hydration has many advantages, such as low price, low toxicity, low smoke, low coloration, etc., and has been widely used in many polymers, such as PVC films, wall coatings, wires and cables, carpets and other flame retardant. This will be the course of political thinking, production practice and experimental skills training organically linked together, which will help students to cultivate comprehensive ability [7].

 

**Improvement of the comprehensive experimental assessment system of applied chemistry**

In the teaching process of comprehensive experiments of applied chemistry, the assessment of students' experimental performance is an important process. In the previous course, the students' comprehensive performance was based on the students' preliminaries, experimental operations and experimental reports in the experimental process, which is helpful for the cultivation of students' practical operation, but there are certain defects, that is, the traditional experimental teaching is based on the experimental results and the writing of experimental reports to determine the students' experimental performance, and it does not reflect the cultivation of students' international vision and innovation ability, so the assessment system of this course needs to be reformed and improved.

Through the reform of the comprehensive experimental course of applied chemistry, we have adopted a diversified evaluation method for the performance evaluation of university comprehensive chemistry experiments. Comprehensive chemistry experiment adopts the combination of usual grades, experimental operation assessment, and inspection report, accounting for 30%, 30%, 40% of the total grade. The usual results mainly examine the students in the class before the experiment of the preparation and attendance, but also focus on the examination of students in the experimental process of experimental operations, coordination between the team, and the experiment report for review, the experiment report should not only reflect the process of the experiment, but also need to have the ability to analyze the experimental phenomena, at the same time, it is necessary to carry out a short summary of each class of experiments to summarize the gains and losses of the experiment, and to cultivate the ability of the students to summarize and analyze. The ability to summarize and analyze. The experimental operation assessment is to select a comprehensive ability of the experiment, let the students carry out on-site operation, focusing on the examination of the students' operation and the ability to solve and analyze the problem. The examination report is to let students design an experiment independently and autonomously, through the literature review and summarization, the experiment should be close to the actual production, and the experimental processes should be reasonable, focusing on cultivating students' hands-on ability and innovative, through the reform of the experimental course, it helps to cultivate the applied chemistry majors with an international outlook and strong comprehensive ability.

## Conclusion

Under the background of new engineering discipline, it is of great significance to cultivate innovative talents, and the reform of comprehensive experiment of applied chemistry as a compulsory course of applied chemistry is of great significance. Comprehensive experiments of applied chemistry is the last experimental course of applied chemistry major, which has the significance of carrying on and starting from the next, not only helps to review and consolidate the basic chemical experiments and experimental ability that the students have learned in the previous stage, but also helps the students to get the postgraduates in the following and complete the graduation dissertation in a high quality and quantity, which lays a good foundation for the scientific research and work in the future. This thesis explores the teaching mode of the course from the aspects of the experimental teaching content and the improvement of the assessment system, which can provide a reference for the reform and construction of the experimental course of applied chemistry.

## Acknowledges

This project is financially supported by the start-up grant (204060032) from Yancheng Teachers University, Basic Research Project of Yancheng (No. YCBK2023014), Education and Teaching Reform Project Funding from Yancheng Teachers University (2023YCTCJGY23, 2023YCTCJGZ07).

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