

Design of ideological and political teaching case of analytical chemistry based on EDTA Titrator

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Abstract. Under the background of ideological and political education in the curriculum, according to the requirements of talent training in applied universities, the authors take the analytical chemistry curriculum as the implementation carrier of ideological and political education. Taking case teaching as an innovative means, a teaching case with EDTA as coordination titrant was designed. Based on the explanation of the principle that metal ions and coordination atoms coordinate to form stable compounds in Lewis acid-base theory, the ideological and political education was effectively combined with the teaching point of analytical chemistry knowledge, and the reason why EDTA had wide adaptability was proposed. From the perspective of ideological and political education, the teaching designs carried out with values education as the main line. The curriculum not only imparted professional knowledge, but also guided students' values. A reasonable teaching design can realize the educational goal of the same frequency resonance between professional courses and ideological and political education.

1 Introduction

Analytical Chemistry is an important basic course for chemistry, chemical engineering, materials, applied chemistry, biology, food, medicine and other related majors[1-2]. It has a complete knowledge framework and strong knowledge intersection with many disciplines. It is a comprehensive discipline based on multiple disciplines and contains rich philosophical ideas and values. The teaching objective of this course is to cultivate students' craftsmanship spirit of striving for perfection, shape engineering ethics, stimulate students' learning interest and patriotic enthusiasm, require students to control the analysis and operation process strictly from the perspective of "quantity", be able to reasonably handle the analysis results obtained, scientifically design analysis plans and write reports. Analytical chemistry has a wide range of applications, closely related to life science, environmental science and material science, and has developed rapidly, such as food safety, environmental protection, new material development, etc., which are closely related to people's lives. In theory teaching, the course not only pays attention to basic theory teaching, but also includes the latest theoretical frontier of analytical chemistry, and timely

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integrates ideological and political teaching elements. The whole course adopts the task driven teaching method and integrates various teaching methods such as case method and discussion method, and provides students with rich extracurricular resources for independent learning[3-4]. In this paper, EDTA titrant is selected to design a case of ideological and political education, so as to achieve the ultimate goal of "establishing morality and cultivating people".

2 Case introduction

Coordination titration is an important part of the teaching content of analytical chemistry. In this case, the teaching content of coordination characteristics and coordination balance between EDTA and metal ions is selected[5]. This case introduces the principle that metal ions coordinate with coordination atoms to form stable compounds in Lewis acid and base theory, and proposes how to select a coordination agent that has extensive adaptability to different metal ions, stimulate students' interest in learning through their independent thinking, then introduces the structure of EDTA as a coordination agent, and introduces the reason why it has extensive coordination ability as a coordination agent; Finally, let the students think about how to choose appropriate experimental conditions to improve the selectivity of titration. Because EDTA can cooperate with almost all metal ions, in the teaching process, gradually guide students to independently find side reactions in various equilibrium reactions, and answer how to define primary and secondary reactions. Finally, how to improve the selectivity of coordination titration through reasonable design of experimental conditions is proposed, which is used as a question for students to think and discuss in groups after class.

In this case, the course mainly integrates the following ideological and political contents: 1. From the experience of Louis, a physical chemist, engaged in scientific research, students feel the outstanding quality of great scientists' unremitting scientific research; 2. Cultivate the students' spirit of exploration to discuss problems step by step by building a step-by-step in-depth solution to the problem of stabilizing metal ion coordination compounds; 3. Fully tap the philosophical dialectical relationship in titration, and cultivate students' scientific spirit of dialectically handling problems; 4. Complete the thinking questions after class through group cooperation.

3 Ideas and objectives

In this case, how to select a universal titrant leads to the reason for selecting EDTA as a coordination titrant. Through the introduction of Lewis theory and the life of chemist Lewis, this paper introduces the use of Lewis theory, and students themselves explain why they chose EDTA as the metal ion titrant. Through the characteristics of coordination between EDTA and metal ions and coordination balance, the dialectical materialism contained in this course is deeply extracted. During teaching, we should consciously and designedly integrate the elements and functions of moral education into the teaching process, practice and explore the ideological and political curriculum, so that all kinds of courses and ideological and political theory courses can go in the same direction and form a synergistic effect. The teaching objectives of course are as showed in Fig.1.

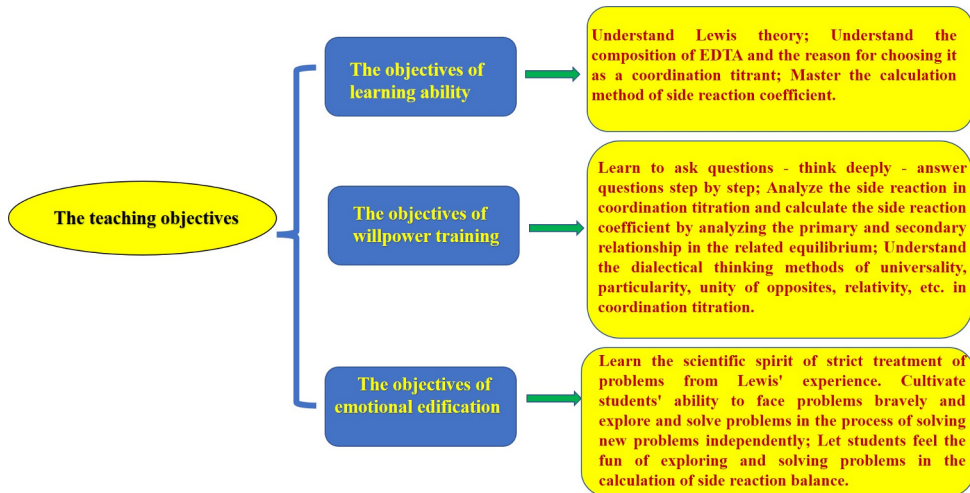


Fig. 1. The objectives of the course.

4 Instructional design

This case selects the lecture contents about the characteristics of coordination between EDTA and metal ions and coordination balance, and deeply explores the ideological and political elements in this case. The main teaching contents are as follows:

First of all, in the form of small videos played in the classroom, we shared the life of Don Lewis, a physical chemist, who had been engaged in scientific research from the age of 70 until his retirement, so that students could feel the excellent quality of perseverance of great scientists. Secondly, by gradually introducing the principle of metal ions and coordination atoms to coordinate to form stable compounds according to Lewis acid-base theory, students will be trained to explore the problem step by step. Thirdly, by fully tapping the philosophical dialectical relationship in coordination titration, we hope to cultivate students' scientific spirit of dialectically looking at problems. Finally, through the way of group cooperation to complete the thinking questions after class, fully stimulate students' independent learning ability, and cultivate students' spirit of unity and cooperation. The specific teaching design was showed in Table1.

5 Features and innovation

The construction of "Ideological and Political Course" can not only achieve the teaching objectives of this course, but also play an important role in cultivating students' dialectical thinking ability, cultivating and practicing the socialist "four self-confidence" and core values, and establishing a sense of social responsibility. After the course, most students feel that they have gained a lot and have more confidence in their major. Many students still communicate with teachers through QQ, WeChat, SMS and other contact methods. When they encounter other problems, they will also consult teachers at any time. This shows that the integration of dialectical thinking and ideological and political elements in classroom teaching can better stimulate students' exploratory thinking, master correct epistemology and methodology, and coordinate the relationship between teachers and students.

Table 1. The specific teaching design of the case.

Main topic	Teaching contents	Objectives	Teaching methods and means
Lewis acid-base theory	Personality of Lewis	Excellent quality of perseverance	Watch video
Selection of coordination titration	Principles for the formation of stable complex compounds	Advocate the spirit of exploration and science	Q1. How to select a titrant with wide adaptability?
Characteristics of coordination between EDTA and metal ions	Strong coordination ability, strong stability, and universality,	Reveal the dialectical relationship of philosophy: universal and special; opposition and unity.	Q1: Why does EDTA have strong coordination ability? Q2: How to select and design titration conditions for coordination titration of different metal ions with EDTA?
Coordination equilibrium	Dynamic Equilibrium and Side Reaction of Coordination Reaction	Reveal the dialectical relationship of philosophy: absolute and relative; Two sides of things	Q1: How do the formation and dissociation of coordination compounds proceed? Q2: How to define the main reaction and side reaction?
experimental design	In the mixed solution where Bi^{3+} and Pb^{2+} coexist, how to improve the selectivity of coordination titration through reasonable experimental conditions design.	Improve students' autonomous learning ability and solidarity spirit	Solve problems through project cooperation

6 Conclusion

At present, the introduction of ideological and political elements into the ideological and political education of analytical chemistry is only a preliminary exploration. In fact, the teaching content system itself and its development process contain many ideological and political elements. To achieve a good ideological and political education effect, it is important to tap the connotation of the current knowledge system, and "timely updating of teaching content and enriching teaching methods" is also a very important aspect. In the teaching of coordination titration, it is the in-depth promotion and expansion of relevant knowledge on the basis of the original teaching content system. It inspires students to master titration and understand titration methods in a dialectical way. In the future, we still

need to constantly explore the ideological and political elements from the teaching content, so as to finally achieve the goal of professional course teaching and ideological and political education to go hand in hand, promote each other, and achieve the ultimate goal of "building morality and cultivating people".

The ultimate goal of higher education is to train students to be all-round development, ability oriented, subject knowledge and dialectical thinking. Therefore, teachers should not only impart professional knowledge to students, but also impart their correct thinking methods, scientific research methods and correct cognitive approaches to scientific development. As the main body of classroom teaching, teachers should not only have a solid foundation of professional knowledge, but also have a certain foundation of dialectics. They should infiltrate dialectical materialism, materialistic dialectics, and dialectical materialistic epistemology into the classroom teaching content without trace, so that they can come at their fingertips, be flexible, open and close freely, and make professional education resonate with ideological and political education, so as to give full play to the teaching and educational function of analytical chemistry, cultivate students to be professional talents with dialectical thinking and scientific exploration spirit.

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