

# Teaching reform and practice of food additives curriculum based on professional certification in Engineering Education

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**Abstract.** The certification of engineering education has become the only way for China's engineering majors to connect with the international standards and continue to develop forward. Under the background of professional certification of engineering education, The problems such as too many knowledge points, poor practical ability and insufficient ideological and political depth in the course of food additives were analyzed, from the theoretical teaching method of establishing project teaching and flipped classroom, a three-level practical curriculum system combining verification, synthesis and design experiments has been built, put forward measures for curriculum teaching reform from three aspects of optimizing curriculum ideological and political design. The above reform measures can effectively mobilize students' learning initiative, to be student-centered and output-oriented, and cultivate students' ability to analyze and solve practical engineering problems.

**Keywords:** Food additives; reform in education; Engineering education certification; Curriculum ideological and political.

## 1. Introduction

The professional certification of engineering education refers to the specialized certification of engineering professional education offered by professional certification institutions for higher education institutions, Its core is to confirm whether engineering graduates meet the established quality standards recognized by the industry, It is a qualification evaluation oriented by training objectives and graduation export requirements [1]. The food quality and safety specialty of Shenyang Institute of Technology began to work on the certification reform of engineering education specialty in 2020, The three core concepts of student-centered, output-oriented and continuous improvement of engineering education professional certification are taken as the starting point and foothold in the formulation of talent training plan, the writing of curriculum syllabus, and the way of curriculum assessment. As an important professional course of food quality and safety, food additives have also carried out a series of teaching reforms and practices based on the professional certification of engineering education and have achieved preliminary results.

## 2. Problems in the course of food additives before the teaching reform

The food industry is known as the sunrise industry. Food additives play a very important role in promoting the development of the food industry. With the continuous improvement of people's living standards, the pace of life has accelerated significantly, people have newer and higher requirements for the taste, flavor, quality, nutrition and safety of food. Food additives refer to chemical synthetic or natural substances added to food for the purpose of improving the quality, color, fragrance and taste of food as well as for the purpose of antiseptics and processing technology [2]. The main contents of the course of food additives include not only the definition, mechanism of action, properties and toxicity of various food additives, but also the scope of use, dosage and method of use of food additives. For students to go to work in the future, it can use food additives scientifically and reasonably, give full play to the role of food additives in the food industry, and lay a good foundation for ensuring food safety.

The traditional teaching of food additives has the following problems, first of all, there are many kinds of food additives with different properties, and the research and application of new food additives are updated rapidly, therefore, the course of food additives has the characteristics of many

knowledge points, independent chapters and high requirements for students' comprehensive quality. In the past teaching process, teachers' teaching methods were single, and it was always difficult to mobilize students' learning enthusiasm through teachers' teaching, resulting in students' difficulty in digesting the syllabus content in class. Secondly, this course is highly applicable. However, the practice hours of the course are limited, resulting in poor practical ability of students, less contact with engineering practice, and weak ability to use the course to solve complex engineering problems [3]. Finally, the "abuse" of food additives has brought more and more attention to food safety. In the previous teaching design, ideological and political content and implementation methods were not highlighted. Under the background that the professional courses and ideological and political courses are in the same direction, it is necessary to integrate the ideological and political materials of food additives, so that students can establish good professional ethics while learning professional knowledge to ensure food safety.

### **3. Teaching reform of food additives course based on engineering education certification**

#### **3.1. Improve theoretical teaching methods and improve learning effect**

Improve teaching methods from the student-centered education concept. The course of food additives involves a wide range of contents, many knowledge points, and there is little correlation between chapters, which makes it difficult for students to remember and digest knowledge points in class. In order to solve the above problems, the course mainly adopts flipped classroom and case teaching to carry out teaching method reform.

In the process of classroom teaching, we should readjust and plan the class time distribution, and transfer the main body of the class from teachers to students. In the design of flipped classroom teaching methods, teachers assign tasks to students closely around curriculum objectives and chapter knowledge points, and let students report projects in groups in class [4]. For example, in the chapter of food nutrition fortifiers, the curriculum outline requires students to master the concepts of nutrients, nutrition fortifiers, food nutrition fortifiers and fortified foods, the types and safe use principles of nutrition fortifiers, and understand the research progress of food nutrition fortifiers. Because students have the learning basis of the food nutrition course, the teacher no longer takes the time of the class to teach nutrients and other information, but divides the knowledge points in this chapter into modules such as vitamin nutrition fortifiers, amino acid nutrition fortifiers, mineral nutrition fortifiers, fatty acid nutrition fortifiers, and each student group receives a module task. To complete these tasks, students need to make a work plan before class. Students can obtain the required materials by watching and consulting the literature library and network resources, questionnaire survey, etc., and report the function, nature, and use method and development trend of the nutritional fortifier in the module to other group students in class. Through flipped classroom, the learning process of students is reconstructed. Teachers can obtain information about students' weak links after class, provide targeted guidance in class, and truly digest and absorb knowledge points through group discussion after class and report and exchange in class.

The case teaching method is that the teacher selects matching cases according to the teaching objectives of the course, organizes students to use their knowledge to conduct a series of activities such as analysis, thinking and discussion on the cases, and enables students to deepen their understanding of knowledge points and improve their ability to analyze and solve problems [5~6]. The course of food additives has strong applicability, and the cases are all real events from life. For example, in the colorants section, the Sudan event was selected for case teaching, and the students were asked to think and discuss the following questions: Is Sudan red a food colorant? What is the role of food colorants in food processing? Use principles, precautions and safety of food colorants. In the whole teaching process, teachers need to distribute case materials, case background and relevant questions to students in advance, students can prepare in advance, use the knowledge of food additives course to analyze problems, during the case discussion, the teacher should guide, through

teacher-student interaction, students' learning initiative is stimulated in the learning process, so as to improve students' ability to raise questions, analyze and solve problems, and deepen the understanding of theoretical knowledge.

### **3.2. Build a three-level practical teaching system based on achievements**

Practical teaching is an important link in cultivating application-oriented talents, due to the limitations of teaching tasks, teaching resources and other factors, the process of practical teaching is relatively weak. Food additives is an applied interdisciplinary subject with strong practicality. According to the survey of employment demand, the talent skills requirements are mainly reflected in that graduates should have practical skills such as food production management, food research and development, and food quality control. Employment-oriented, in the process of teaching, we should pay attention to the combination of theory and practice. According to students' cognitive rules and learning progress, the practical course of food additives is divided into three levels, with basic theory as the cornerstone, production practice as the main line and innovation and entrepreneurship as the goal [7]. That is to understand and accumulate theoretical knowledge through confirmatory experiments, master the production and operation skills of food industry through comprehensive experiments, and cultivate students' innovation and entrepreneurship ability through design experiments. For example, theoretical knowledge such as the nature, properties, toxicity and use methods of sweeteners will be explained in class, Through the confirmatory experiment, students are asked to prepare sweeteners and taste them in groups, and students are asked to summarize the taste characteristics and properties of sweeteners; For example, in the comprehensive experimental design, students are allowed to taste common drinks in the market, and similar products are formulated through comprehensive utilization of colorants, essence, and food flavorings; For example, in the design experiment, students are assigned new product research and development tasks, and students must conduct food research and development through market research, literature review and other methods. In the construction of the three-level practical teaching model, the confirmatory experiment, as the "trunk", ensures the overall ability of students to master basic knowledge, the comprehensive experimental practice acts as the "branch", extends and develops the theoretical knowledge, the design experiment acts as the fruit, and tests the students' learning achievements.

### **3.3. Strengthen ideological and political education of curriculum with professional skills and knowledge as the carrier**

With the development of modernization and industrialization and the improvement of people's living standards, people pay more attention to food safety after eating and clothing. Due to the lack of morality and integrity, and the use of illegal additives, food safety incidents occur frequently. In order to ensure safety, in addition to the support of policies, standards, laws and regulations, it is also necessary to strictly restrict the ideological and moral of personnel engaged in the food industry [8]. Therefore, through the course teaching of food additives, it is of great significance to cultivate the students of food specialty to have the sense of honesty and law, and establish good professional ethics. See Table 1 for the ideological and political design ideas of the course.

**Table 1.** Ideological and political design ideas of food additives course.

Objectives of ideological and political education	Integration point and teaching carrier of ideological and political education
Carry forward China's excellent tradition and cultivate students' cultural self-confidence	The introduction module introduces and mentions the use of brine and gypsum to solidify soybean milk in Qimin Yaoshu, and explains the history of food additives;
Cultivate critical spirit and scientific literacy	The essence and spice module mentioned the story of Academician Sun Baoguo, and understood the outstanding contributions made by contemporary food experts to the field of essence and spice in China; Food preservative module, through talking about the social phenomenon of "adding" color change, guide students to think and analyze some hot issues such as misunderstanding of additives in society from a scientific perspective;
Abiding by laws and regulations and being honest and trustworthy	Food colorant module, Review of "Red Heart Duck Egg" and "Dyed Mantou", Correctly distinguish illegal additives and food additives, and clarify the scope and dosage of additives;
Cultivate innovative spirit and independent development ability	Food flavor agent module, this paper introduces the natural sweeteners of sugar alcohols from the perspective of health, which have excellent characteristics such as low calorie, high tolerance and anti-caries.

#### 4. Conclusion

Under the background of engineering education certification, this paper analyzes the problems existing in the course teaching of food additives in the past, focusing on three aspects: optimizing teaching methods, constructing practical teaching system, and deepening the course construction. In the actual teaching process, the reform has achieved good results, but also exposed some problems, which need to be further improved in the follow-up work.

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