# Application Research of Modular Teaching in Water Treatment Biology

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**Abstract:** In order to break the boring learning method, and enhance students' applied innovation ability, this paper discusses the modular knowledge decomposition reform of water treatment microbiology based on the specific situation of the students majoring in water supply and drainage in Yulin College. This paper starts with the three sections of basic knowledge, practical application and experimental operation, and introduces its main content and the specific learning methods of the knowledge points of each section, hoping to help students learn this course effectively.

## 1. Introduction

Microbiology is the water supply and drainage water treatment science and engineering students an important professional basic course, which package contains the basic morphological and physiological characteristics of the microbes, the concrete application of microorganism in water treatment, water quality and biological monitoring, it is engaged in various water supply and drainage professional students must rely on the practical work of knowledge.

In practice teaching of the course arrangement in specialized course is relatively heavy junior, combining my teaching experience for many years, found the creatures of the students basic knowledge is weak, and related chemistry knowledge and basic experimental operation ability is relatively less, not good at summarizing, especially for microbial this pure text course, learned knowledge after a chaotic, not well are summarized and the application of knowledge points, and the course and one's deceased father grind as water supply and drainage professional course, review the effect not beautiful, in the late for this course learning effect is not obvious, to “modular” teaching idea is introduced into teaching,Here, the knowledge points will be summarized into three modules according to the textbook: basic knowledge teaching, practical application teaching and experimental operation teaching. The following sections respectively illustrate each module from knowledge points to specific teaching methods.

## 2. Knowledge System Modularization

### 2.1 Basic Knowledge Teaching

In practice teaching, the basic knowledge of microbiology is indispensable, and its study has paved the way for the later practice teaching. Here, the contents of common microorganisms in water are divided into three categories: on the one hand is divided into prokaryotes, eukaryotes and viruses according to their structural characteristics, mainly talking about their structural characteristics and physiological characteristics;on the other hand is mainly about microbial metabolism and nutrition, respiration and metabolism. A class of teaching microbial growth and heritable variation. In view of the teaching of basic knowledge module, certain methods should be taken.

First, in addition to the traditional teaching method, a large number of dynamic pictures and video will be used to explain the internal structure of microorganisms for each knowledge point, which can alleviate the boring and abstract knowledge point and form a distinct visual effect.[2]Second, for each of its physiological characteristics and the specific application, mainly relying on its special structure, so the classroom must be fine, fine, the so-called is aimed at the

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structure of the picture, to be familiar with to distinguish it, and can quickly tell it the function of the application, in detail its working principle, and can contact the actual application. Thus the knowledge system of a class of microorganisms is established. Thirdly, for the teaching of microbial nutrition metabolism and genetic variation, the main knowledge line should be given priority to, not too much to teach trivial knowledge points, grasp a main line, take its essence, concise and systematic to the knowledge point indoctrinate. For example, the four pathways to dehydrogenation of the matrix, the diagram of the pathway in the textbook is very cumbersome. Surfaces with complicated organic chemical name, it is difficult to understand students reflect, here we can simplify the schematic diagram, through large frame diagram and key material qualified part of the text description reflects its reaction pathways, and compare four kinds of ways and, more clear fully embodies the principle of the process of four kinds of ways.

### 2.2 Practical and Applied Teaching

The practical application teaching module is mainly aimed at the sewage biological treatment unit and the purification of aquatic plants. Based on the biological treatment methods commonly used in actual sewage treatment projects and the development trend of the future ecosystem, this module is mainly divided into three parts: First, decomposition and transformation of pollutants by microorganisms; Second, the main microorganisms in the sewage biological treatment system; Third, water purification of aquatic plants.

#### 2.2.1 Microbial Decomposition and Transformation of Pollutants

In sewage treatment, the main treatment object is organic matter, and the biological decomposition and transformation status of organic matter is even more important. The decomposition of organic matter can be roughly divided into two types based on the actual situation of sewage treatment: aerobic biological decomposition and anaerobic biological decomposition. In the actual sewage treatment process, denitrification is a relatively important link, and the decomposition of organic matter can also be learned according to whether the organic matter contains nitrogen. For example, the decomposition of organic matter without nitrogen can be represented by biological decomposition of different kinds of organic matter, such as the decomposition of cellulose, starch and hydrocarbon. The decomposition of nitrogen-containing organic matter involves three functions: ammoniation, nitrification and denitrification. Besides, inorganic substances still exist in sewage. Transformation of common inorganic elements is also described here, such as transformation of sulfur by vulcanizing bacteria and sulfur bacteria, removal of phosphorus by phosphorus accumulating bacteria, transformation of iron by iron bacteria and so on.

For this piece of knowledge to learn, in addition to the main principle of knowledge teaching, here with a lot of practical engineering case study, such as nitrogen phosphorus removal process of oxidation ditch, SBR treatment of sulfate wastewater, etc., it is only through the actual touch of structures, analyzes in detail the processing principle and the role of the microbial, students' interest in learning will be more strong, at the same time, for later study wastewater treatment engineering courses have a better knowledge.

#### 2.2.2 The Main Microorganisms in Wastewater Biological Treatment System

The most common biological treatment methods are activated sludge process, biofilm process and anaerobic biological treatment. In each treatment method, there are many microorganisms that play different roles and perform different purification functions. In activated sludge process, in addition to a large number of bacteria, there are protozoa and metazoa. Here, the appearance of protozoa and metazoa can be used as indicative organisms to reflect the treatment effect of activated sludge process. In biofilm method, the composition of membrane structure and the type of microbiological attachment determine the treatment of biofilm method. Anaerobic biological treatment, mainly used in the digester, mainly involving the technology with anaerobic fluidized bed, UASB reactor, anaerobic biological filter and so on, here head distribution is also have certain regularity of fungi, such as the outermost is methane bacteria, fermentation bacteria and hydrogen

production type lining for acetic acid production of methane bacteria and hydrogen production to produce acetic acid bacteria.

For a wide variety of microorganisms, to place it in a specific process environment, from the analysis of it in the process of action principle, and further contact its physiological behavior, and its research progress and application in other practices, and expand the application scope of knowledge for students, late for one's deceased father grind the road.

### 2.2.3 Water Purification of Aquatic Plants

Water body has a certain self-purification function, among which, in addition to the various functions of microorganisms, aquatic plants also have the functions of maintaining the quality and quantity of water environment and controlling the eutrophication of water body. Aquatic plants can transform organic matter, absorb nitrogen and phosphorus and remove heavy metals. Aquatic plants have certain practical applications in the restoration of water bodies. For example, floating plants can not only inhibit the growth of algae, but also decompose a large number of organic matter and absorb nitrogen and phosphorus, which are mainly used in oxidation ponds. Water-bearing plants are mainly used in constructed wetlands. Submerged plants are especially used for the treatment of eutrophic shallow lakes.

As it is located in the north, many students are unfamiliar with these plants. We need to look for a lot of pictures to help students gain a deep impression. At the same time, we need to find more opportunities to lead students to visit and practice.

## 2.3 Experimental Operation Teaching

This course has a total of forty-six class hours, among which sixteen class hours are devoted to experiments, and there are eight experiments in total. For the original theory part of the experiment, it is scattered in each chapter. In addition to normal teaching, the experiment part needs to make special experimental explanation to make up for the scattered knowledge points of students in the early stage. In addition, the experiment part requires students to have the most basic experimental operation foundation, such as the use of microscope, slide making and so on. According to the arrangement of the experimental course, it can be roughly divided into three modules.

### 2.3.1 Basic Experimental Module

Basic experiment part accounts for 50% of the total experiment, including the use of microscope, microbial morphology observation, the preparation of culture medium and sterilization technology, this section mainly reflects the most basic experimental operation knowledge and skill, in this section, be sure to let students to master the skills, ensure a microscope one to two people, everyone to submit different slices of microbial shape figure, everyone in person for glass packaging and sterilization process, only skillfully master the basic experimental skill, to other related experiment was carried out, which laid a foundation for later research learning at the same time.

### 2.3.2 Comprehensive Experimental Module

The comprehensive experiment module, which accounts for 30% of the total experiment, mainly includes pure strain separation and culture of microorganisms and inoculation technology, microbial count and coliform group test. This module not only requires students to be proficient in experimental operation, but also requires students to be very clear about the experimental principles, to make original analysis of the experimental problems and give constructive Suggestions. Inoculation cultivation of microbes, for example, in technology, it requires that the students can expertly glassware sterilization, made for different types of nutrient medium, tablet and cant inoculation technique, at the same time, to cultivate microorganisms need to observe flora, and dyeing technology is used to determine the judgement of fungi and attributes, and use count count to determine the size and number, and so on. It can be seen that comprehensive experiments not only require students to have a solid foundation of knowledge, skilled operation technology, and a certain ability to analyze and judge the experimental results, which can strengthen students' thinking ability and facilitate the development of scientific research.

### 2.3.3 Design Experiment Module

The design of experiment module accounts for 20% of the total experiment. The main task here is to ask students to conduct experiment design in groups of two-three according to a given topic. Each group is required to provide complete experiment steps, be very clear about the experiment purpose, and regularly organize time to report the experiment. For example, the opportunity to practice in sewage treatment plant can be used to obtain certain activated sludge and conduct microbial separation and purification, so as to analyze the mechanism of action of these microorganisms in water treatment, and to study the treatment effect similar to sewage by cultivating the bacteria.

## 3. Conclusion

With the mature development of sewage treatment technology, biological treatment has become the core technology in the future, so it also laid the importance of water treatment microbiology course. Here in combination with the principle of our school applied colleges, as well as for students majoring in water supply and drainage professional requirements and future employment trend, which will be the course module analysis, mainly contains the basic knowledge, practice teaching, experiments of three sections, and the main content of each section and learning method has carried on the detailed analysis, and hopes to make students through the knowledge of the modular division clearer understanding of the knowledge, and use effective learning methods in each section point of interest, expanding knowledge, can really do is derived from the practice, apply it to practice.

## References

[1] Gu Xiasheng, Hu Hongying etc.Water treatment biology(the fifth edition)[M]Beijing: China Architecture & Building Press,2011.

[2] Jin Xunxiao, Wu Changhang (2009).Exploration on teaching reform of water treatment microbiology[J].Science and Technology Innovation Herald ,Vol.105,No.28,pp,20-21.

[3] Yang Weiwen(2009).Discussion and practice of segmental modular teaching reform[J].Science and Technology Innovation Herald ,No.7,pp,154-155.

[4] Yang Zhaohui, Zeng Guangming (2003).Exploration and practice of teaching reform of environmental engineering microbiology[J].University education science ,No.4,pp,45-47.