

# On the Reform of Green Chemistry Experiment Teaching in Colleges and Universities

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**Abstract :** In recent years, the environmental problems caused by the progress of human society are increasing day by day, making chemists face more and more new challenges. For the progress of modern human civilization, chemistry is indispensable, but now it is flooded by colorful waste residue, smoke and sewage, causing people to feel disgusted with chemistry. At the same time, people began to avoid and fear chemical-related things and refused to accept any food additives. The price of some chemical fiber fabrics has been falling, leading to the popularity of cotton fabrics. There is a constant emphasis in the cosmetics industry on using natural ingredients and so on. The pollution of waste gas, wastewater, solid waste and toxic chemicals in the environment also creates fear when people talk about chemistry and the chemical industry. In this case, the development of the chemical industry needs to consider the relevant requirements of society, economy and environment. The idea of green chemistry was developed under the influence of the idea of preventing pollution.

**Keywords :** Teaching in Colleges and Universities; Chemical Experiment; Reform in Education;

Nowadays, there is a wave of green chemistry research around the world, aiming to eliminate pollution from the source and advocate a sustainable green economy. This is an important characteristic and development direction of modern chemistry teaching, which arouses people's general concern. As a characteristic of all chemistry disciplines, the importance of experimental teaching cannot be ignored. It has a direct and close connection with green chemistry, and it is of great significance to integrate green chemistry education into it. It can be used as an important way to carry out green chemistry education for students, and meet the needs of sustainable development of society, chemistry curriculum reform and discipline development and quality education. This research has an obvious effect on environmental protection, good economic benefit and important educational value.

## 1. Problems existing in green chemistry experiment teaching in colleges and universities

### 1.1 Lack of knowledge of green chemistry

The lack of green chemistry knowledge and the narrow access of students also reflect that chemistry teaching does not pay enough attention to green chemistry education. Students understand the advantages of chemistry to life and their learning attitude is positive, but the main body of the current teaching process is still teachers rather than students, and there is too little interaction between teachers and students. As a result, the learning process of chemistry is boring. Students do not really participate in learning and think independently, but passively receive it. This greatly restricts the development of students' self-learning ability and thinking ability, so we should optimize the teaching strategy of green chemistry infiltration in chemistry teaching, so as to improve students' interest in learning.

### 1.2 The degree of understanding of teachers is insufficient

At present, teachers' understanding of green chemistry and environmental protection in chemistry teaching is not enough, and the teaching content mainly tends to impart theoretical knowledge pertinently. The teacher did not combine the concept of green

chemistry to further guide students to explore and think deeply, and failed to develop and exercise students' independent inquiry ability well.

### **1.3 Chemistry is underutilized**

As an important basic subject, chemistry has its own characteristics, but teachers do not make full use of them in the teaching process. For example, the combination of chemical experiments enables students to feel the reaction process more deeply and deepen their understanding of material properties or chemical reactions. And using a variety of models or literature materials supplemented with the theoretical knowledge of textbooks, enhance students' interest in learning and exploring spirit.

## **2. Significance of green chemistry experiment design**

### **2.1 The role of chemical experiments in human development**

Chemistry, as a central subject, together with physics and mathematics, constitutes an important part of human innovation and transformation of nature, promoting the rapid development of natural science and improving production and living standards. Over the past century, human beings have turned to the development of chemical science to deal with serious problems such as environmental degradation, resource scarcity and population growth. It can be seen that chemistry and human development are interdependent, and the progress of human civilization needs chemistry. Chemical experiment is not only an important means of chemical research, but also an important part of chemistry. The development of chemistry is inseparable from chemical experiments, and many problems need to be properly solved by experimental exploration and simulation. From this point of view, the contribution of chemical experiments to human beings is very huge. Its role is mainly reflected in the following three aspects: First of all, it promotes a better understanding of the laws of nature; Secondly, it also promotes the effective improvement of the quality of human life; Thirdly, it promotes the coordinated development of human beings and nature.

### **2.2 The role of chemical experiments in chemical education**

First of all, chemical experiments can help students improve their scientific literacy, help them understand related chemical terms and concepts, and consolidate their basic knowledge and experimental skills. Secondly, students can experience chemical experiments themselves, thus forming a positive spirit of exploration and rigorous attitude towards chemistry. Finally, students can gain insight beyond textbooks, which is beneficial to the formation of values, emotions and attitudes, and promotes and enhances scientific literacy.

Secondly, chemical experiments are helpful to cultivate students' lifelong learning ability. Since the implementation of education reform in the new century, China has been committed to the cultivation of lifelong learning ability based on the all-round development of all students. The continuous development of chemistry promotes the continuous development of chemical experiments, and the teaching of chemistry course pays more attention to the teaching of chemical experiment process and method, so that students can experience the fun of cooperating with each other in chemical experiments and analyzing and discussing the results through personal participation. At the same time, it can enhance students' learning ability, cooperation ability, problem-finding and problem-solving ability, evaluation and reflection ability.

### **2.3 Necessity of infiltrating green chemistry idea into experiment teaching**

As the frontier of chemical education, green chemistry is a necessary stage in the development of chemical education and an important part of the implementation of sustainable development strategy, which is conducive to the comprehensive cultivation and development of individual quality. As a chemical worker, we must have relevant knowledge and common sense of green chemistry to provide guarantee for the construction of a better future. As an important means of chemistry education, it is also obvious that it is necessary to infiltrate the concept of green chemistry, which is needed for the sustainable development of mankind, society and chemistry.

## **3. Principles of green chemistry experiment design**

When designing a green chemistry experiment, it is necessary to rationally plan and arrange the principle, procedure and device of experiment according to certain requirements and standards. In general, the following principles should be followed:

(1) Scientific principles: Ensure the correctness of experimental principles, operation method and implementation process, that is, the basic requirements of experimental design;

(2) Security Principal: Ensure the protection of the human body, instrument and environment during the whole experiment is an important requirement of experimental design;

(3) Operability Principles: Ensure the experimental operation is feasible, the instrument and reagents as simple and easy to

obtain;

(4) Principle of minimalism: The experimental scheme should be as simple and easy to operate as possible. It should have the simplest experimental device, optimal experimental steps, minimum drug dosage under the same experimental effect, and the conditions should be easy to control, and the reaction time should be shortened as far as possible.

## **4. Green chemistry experiment design method**

### **4.1 Improving the experimental principle**

In undergraduate chemistry experiments, a variety of toxic and harmful chemicals such as  $\text{Cl}_2$ ,  $\text{SO}_2$  and  $\text{H}_2\text{S}$  will be produced, which will cause serious pollution to the environment. However, the experimenter can reduce chemical contamination by changing the reaction route, optimizing the reaction method and cleverly designing the experiment to achieve the desired experimental purpose.

### **4.2 Controlling the experimental conditions**

When designing experiments, there are many ways to make them greener. For example, optimizing drug proportion to reduce drug dosage, screening for cleaner catalysts, optimizing the reaction time and so on.

### **4.3 Improving experimental method**

The optimization of traditional experimental methods to reduce pollution is the embodiment of a green chemical experiment. For example, the use of miniaturization or small-scale experiments to greatly reduce the number of reagents, reduces the reaction time and protects the environment and is safe and reliable. The experimenter integrated the dispersed experiment, making full use of substrates and products to carry out a series of reactions, so as to save drug dosage, reduce environmental pollution, and gradually improve the comprehensive experiment.

### **4.4 Standard operation and proper disposal of “three wastes”**

Teachers guide students to correctly deal with the “three wastes (waste gas, wastewater, solid waste)” of the experiment, which is not only conducive to the formation of experimental habits, but also to the cultivation of comprehensive quality, making the chemical experiment scientific, standardized, green, to protect the environment to provide an important guarantee.

In a word, in experimental teaching, students can apply the knowledge of green chemistry into experiments and learn green experimental techniques through the selection of reaction principles, experimental methods, device design, treatment of “three wastes”, and development and recycling of experimental resources. In this way, students can truly understand green chemistry, learn to use the principles and methods of green chemistry to prevent and deal with experimental pollution, and gradually form the concept of green chemistry and environmental protection.

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