

# Study on case of extracurricular simple chemical experiment in middle school

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**Abstract.** The extracurricular simple chemical experiment is an extension of chemistry classroom experiment in the middle schools. It contains interesting experiments, micro-experiments, and family experiments. It has the characteristics of less drug consumption, simple operation, close to life, and environmental protection. Based on the investigation of the development of the simple chemical experiment in middle schools at home and abroad, the design of the extracurricular simple chemical of brewing wine was carried out. Through research, it is found that in the process of implementing extra-curricular simple experiments, students can not only exercise their hands-on ability and enhance their sense of innovation, but also demonstrate the important auxiliary role and good development prospects of extracurricular simple chemical experiments in middle school's chemistry teaching.

## 1.Introduction

The new curriculum concept puts forward higher requirements for the scientific and exploratory nature of chemistry experiments. It is very necessary to adapt to the development of this concept and improve the enthusiasm of junior high school students for chemistry. [1] Extracurricular simple experiment is an effective auxiliary method for junior high school students to learn chemistry. It can not only practice the miniaturization, environmental protection and life-oriented design of simple experiments, but also practice the new trend from life into chemistry and from chemistry to society. The curriculum concept can also enhance teachers' innovative thinking and stimulate students' interest in chemistry learning, which is of great significance to junior high school students who are new to chemistry. [2-3]

## 2. Research background and significance

### 2.1 Research status at home and abroad

Many experts and scholars at home and abroad have conducted a series of experiments related to extracurricular simple experiments, such as fun experiments and family experiments. [4] The simple experiments was first made into the knowledge field of middle school in the subject of chemistry in United States, and began to walk into the textbooks and entered the daily life of students. It can be seen that: extracurricular simple experiments is showing the strong charm in middle school chemistry. [5] Due to the large population, there are certain differences in educational resources and education in various places. Many poor and poor areas have little or no understanding of simple experiments, and the start of micro-chemistry experiments in China. Compared with the United States and other



Western countries, it is a very challenging and difficult task to conduct extracurricular simple experiments in our middle school.

Through the examination of relevant literatures, it is found that the domestic research on extracurricular simple chemistry experiments is mostly based on the improvement and simplification of the original junior high school chemistry experiments. [6] For example, reducing the use of chemical reagents during the experiment, finding a feasible chemical dosage ratio, or using the common items in life to conduct experiments, not only saves chemicals, simplifies the operation steps and experimental instruments, but also reduce the pollution, which is the green chemistry and environmental chemistry that is strongly advocated by today's society. Among them, G-M. Li in the "J.Edu. Teaching Forum" published "the junior high school chemical innovation micro-experimental design four" in the textbooks in some experiments have been improved design. He believes that the instruments required for improved experiments are smaller, cheaper, and less costly. For example, he designed the "carbon monoxide reduction copper oxide experiment", which uses a waste electric iron for heating, can be reused, and does not need to clean the instrument. The reaction of toxic carbon monoxide and excess copper oxide will not cause pollution, which is more practical than the experiment on the textbook. which not only saves experimental drugs, but also avoids unnecessary waste, and complements the concept of green chemistry .

S.Zhang, from the middle school of Beijing Jiaotong University, designed the "making sushi" experiment in the rational diet. She asked the students to check the chemical knowledge in the ingredients, select the ingredients, prepare the ingredients, and make the extracurricular simple by making sushi and sharing the production principles. The experimental operation is well integrated into the classroom learning, which is a successful attempt to combine the simple extracurricular experiment with the classroom experiment. The experiment is divided into three parts: one is the independent design of the students before the class, this part emphasizes the participation of the students, and can gain the development of their own ability through this link; the second is the production of sushi in the classroom, through which the efficiency and quality of the experiment are guaranteed. The last link is the exchange report after the event. This link is not only a test of the previous stage of teaching, but also a rich and development of the connection between nutrients and food.

In addition, in order to better understand the development of extracurricular simple experiments in middle schools, relevant interviews were conducted for three middle schools in Qingdao city. Through investigation and research, it was found that the frequency of extracurricular simple chemistry experiments in some schools is relatively low. The school has not been carried out, which is unfavorable for the improvement of students' ability and the cultivation of innovative talents. Secondly, the survey results showed that many teachers are accustomed to traditional classroom experiments. The enthusiasm of teachers' creativity and chemistry teaching research is not very high, professional literacy needs to be improved, and the promotion of inquiry experiments under the new curriculum reform situation is not great; In the second semester of the second year of the semester, it is necessary to carry out simple experiments in chemistry, and it is necessary to carry out chemical enlightenment education for students. It can not only reduce their learning pressure during the third year, but also enable them to discover the joy of chemistry in the experiment. The learning is based on interest.

## *2.2 Research content*

The junior high school extra-curricular simple chemistry experiment is mainly based on the inquiry experiment on the chemistry textbooks. The improvement and modification of the corresponding experimental device are carried out, and the dosage of the experimental drug is simplified according to the appropriate reaction ratio to reduce waste. Simplify the experimental steps under the premise of ensuring that the experiment can react normally, giving the experiment different meanings, making it more "grounded" and stimulating students' interest in learning chemistry. Under the new curriculum concept, students are encouraged to think about themselves, do it themselves, and solve problems themselves. By conducting extracurricular simple experiments, students can better experience chemistry and comprehend the relevant chemical knowledge involved in the experiment. [5]

Extracurricular simple experiments may increase the opportunity for students to experiment, from boring theoretical knowledge to interesting experimental phenomena, from experimental phenomena to knowledge understanding, students' own abilities are improved, so that they truly experience in life. Chemistry, Students can better understanding of chemical concepts [2]

*2.2.1 Fun experimen* The fun experiment is a kind of experiment that is interesting and has a very novel form of expression, highlighting the chemical principles exhibited by experimental phenomena such as sound, color, light, and state. Compared with conventional experiments, fun experiments are characterized by fun, simplicity, ingenuity, economy, and innovation. Such experiments can motivate students' enthusiasm for learning and stimulating their interest in studying chemistry.

*2.2.2 Micro experiment* Micro-experiment uses the least amount of medicine to achieve the best experimental results. The dosage of drugs and reagents is usually only one tenth to one thousandth of the conventional experimental dosage. It has simple operation, less pollution, convenient time saving and safe operation. And the effect is intuitive and obvious, with good teaching practice effect, has been widely used in junior high school chemistry teaching practice, and played a vital role in the field of experimental teaching reform.

*2.2.3 Family experiment* Family experiments can use the common items in household life or waste materials as experimental equipment and medicines, and the operation process is not limited by time. Students can fully observe and study the experiment, and improve students' sense of innovation and practical ability. The family experiment includes the characteristics of flexibility, interest and applicability. In the implementation process, students, who's parents, and teachers need to cooperate with each other, which is conducive to students' better study of chemistry.

### *2.3 Significance of the simple experimental design for junior high school chemistry*

(1) Since the reform of the new curriculum, Scientific inquiry has vigorously advocated to improve students' scientific thinking and hands-on ability in China. Chemistry is an experimental-based discipline. Designing and researching related experiments makes it simple and life-oriented. [4]

(2) The continuous development of society requires teachers to become research-oriented professionals, and teachers are not only evangelistic dearists should also study textbooks and improve experiments from the disciplines, so that students can discover the mystery of chemistry in some "different" experiments. [5]

(3) Since chemistry and life are inseparable, then some common things such as sugar and salt are used in life. The extracurricular simple experiment has a great effect on the enlightenment of students. Not only they can discover the charm of chemistry in the process of finding materials, preparing experiments and hands-on operations, but also release their great potential.

(4) Designing and researching middle school chemistry extracurricular experiments is conducive to improving students' scientific literacy and enhancing students' hands-on ability to further promote the development of quality education.

(5) The research on middle school chemistry experiments will help teachers and students in middle schools adapt the requirements of modern society.

## **3. Cases Brewing wine simple experiment design**

### *3.1. Experimental purpose*

By making wines students may understand the principles of grape fermentation, it is found that chemistry is closely related to life.

### *3.2. Experimental principle*



Yeast converts the sugar in the grape juice into carbon dioxide and alcohol. The carbon dioxide overflows from the liquid in the form of a gas, and the mixture of alcohol, water and other substances left in the container is wine.

### 3.3 Experimental procedure

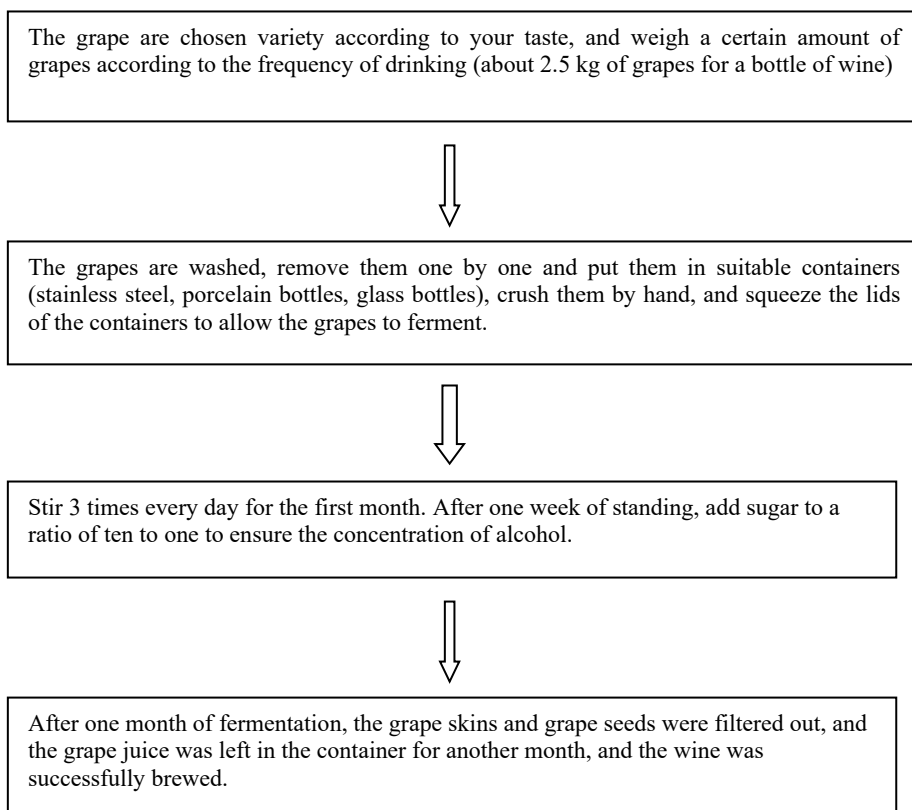


figure 1 making wines experimental procedure

### 3.4. Precautions

- (1) When crushing grapes, the peel and pulp must be completely separated;
- (2) It is particularly important to note that the container cannot be sealed during fermentation, otherwise there is a risk of explosion.
- (3) After filtering the grape skin and grape seed, keep it away from light.

### 3.5. Experimental results and discussion

Through the brewing of wine, the students' hands-on ability is exercised, and the principle of grape fermentation is preliminarily understood. In addition, the experiment needs to cooperate with parents and enhance the communication between students and their parents. Their Parents and teachers cooperate with each other. The study of chemistry knowledge that is conducive to students is of great significance in promoting the development of extracurricular simple experiments in middle schools.

## 4. Results and discussion

Through the exploration and in-depth understanding of the extra-curricular simple experiment in junior middle school chemistry experiment, it is found that compared with the chemical experiment in the textbook, the junior high school chemistry extra-curricular simple experiment has some advantages which is not reflected in the original junior high school chemistry textbook.

(1) Simple operation and less pollution. Because the instrument of chemical simple experiment is relatively small, the amount of medicine added to it is relatively small, and a small number of experiments have certain dangers in the experiment of the original textbook. The reduction of the amount of medicine used in the chemical experiment will correspondingly reduce the experiment. The risk factor. In addition, because the amount of drug used in the experiment is relatively small, it will also reduce the pollution caused by some experimental reactions. In the simple experiment, the researcher's own design equipment is often used or the common items in life are used, which not only reuses resources, but also facilitates the development of simple experiments.

(2) Close to life and attitude. Extracurricular simple experiments are mostly carried out using items commonly used in life. For example, the "early cooked eggs" experiment is to use common eggs, quicklime, tap water and other materials to give students a kind of "intimacy" and stimulate their curiosity. And the interest in learning is also in line with the requirements of the new curriculum reform for chemistry teaching.

(3) Saving experimental funds. According to the research comparison, the amount of reagents used in the simple experiment of junior high school chemistry is less than that in the original textbook experiment. The waste medical syringe, plastic bottle, laundry liquid and other materials are used to replace the more expensive chemical instruments and reagents in the original textbook. The cost can be reduced, and the experimental results presented are very good. For example, the "injection foam fire extinguisher" experiment is to use a medical waste syringe to be converted into a small foam fire extinguisher, which not only has obvious experimental phenomena, but also reduces experimental expenses.

(4) Save time. Since the simple experiment instrument is simple and easy to obtain, the device design is miniaturized and the amount of medicine used is relatively small, so it can save a lot of time. For example, in the design of the intermolecular gap experiment, the amount of alcohol and water is only one tenth of the original textbook experiment, the amount is reduced, and the operation saves time and does not waste drugs.

(5) Practicality. Simple experimental instruments are common items in daily life or re-use of common items, and they are relatively cheap. Finding a material production experiment device can not only improve the operation ability of middle school students' chemical experiments, but also stimulate them to conduct chemical experiments. The interest and interest in the discipline of chemistry has been significant. For example, in the experimental design of sushi production, students prepare their own experimental supplies, make materials for sushi, and work together in a series of processes such as sushi making to exercise their hands-on ability and improve their self-exploration ability. .

Therefore, in the chemistry experiment in junior high school, we should strengthen the design research and development of simple experiments, improve the experimental innovation ability of teachers and students, make the junior middle school chemistry really start from life, enter the school, enter the classroom, and develop students. Innovative spirit and practical ability to cultivate talents that meet the development requirements of the times.

By hands-on and easy-to-learn simple experiments, students can not only develop their chemistry vision, but also have an important role in improving their innovative thinking consciousness and hands-on ability. Through the simple extracurricular experiments related to design research, teachers have enhanced their professional literacy and enthusiasm for chemistry teaching research, and prepared for the progress and improvement of chemistry teaching in the future. Teaching is no longer a simple teaching material, but a textbook. Excavating more chemistry knowledge that is beneficial to students and improving their abilities, this proves that extracurricular simple experiments have great significance and good development prospects in junior high school chemistry teaching.

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