Two Fun Chemistry Experiments Design in Science and Technology Laboratory for Middle School Students

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Abstract. In order to promote the scientific interest and cultivate the innovating ability of primary and secondary school students in science, our institute has established a science and technology laboratory for primary and middle school students who are open to the public. The fun chemistry experiment carried out by the laboratory can not only achieve the cultivation of chemistry knowledge and practical innovation ability of primary and middle school students, and at the same time it also provides a platform for the training of chemistry teachers' teaching skills, effectively solving the training objectives of colleges and universities, and broadening the employment scope of chemists. Using simple chemicals and instruments to reveal the chemical problems in life with simple and clear phenomena, it will be easier for students to understand the chemical knowledge in life and improve students' interest in studying chemistry.

Introduction

Designing some feasible and interesting experiments to enable students to understand life-related chemical knowledge simply and clearly. It is easy to design and implement chemical experiments, so that students can understand the mystery of chemistry through the phenomena of chemical experiments. Through reading the existing literature, it is found that students generally acquire a lot of knowledge about interesting experiments through family experiments or some related videos on the Internet [1]. For example, using the common purple cabbage juice on the table to test the family's acid and alkali (vinegar, lemon juice, baking soda, soap water, etc.). Up to now, Northwest University College of Chemistry and Materials Science has established and opened an "Interesting Chemistry Laboratory for the Future". The main purpose is to design some new experimental contents which follow the principles of chemical experiments, which are simple to operate, easy to observe and novel to students. These experimental contents can stimulate students' interest, thus arousing students' initiative in learning. It is easy for students to understand. These experimental contents can adjust the classroom atmosphere, cultivate and strengthen students' thinking ability, further improve students' comprehensive quality ability [2], and lay a certain foundation for students to learn chemical knowledge in the future. Such as "secret intelligence" and "Shenshui Xianzi", these experiments can let students understand the reaction between indicator (phenolphthalein) and acid-base, and enable students to observe the experimental phenomena intuitively. According to the literature reports, East China Normal University has also established relevant popular science laboratories and carried out similar chemical experiments. In this article, fun chemistry experiments were designed.

Experimental Designing

The Content of Vitamin C in Different Vegetables

The purpose of the experiment is to understand the content of vitamin C in different vegetables and fruits by means of experimental comparison, so as to cultivate students' thinking ability and
experimental practical ability. Experimental instruments include spinach, orange, mortar, disposable transparent plastic cup, beaker, dropper, gauze, potassium permanganate solution. Experimental principle are that all vegetables and fruits contain a certain amount of vitamin C, different fruits and vegetables have different content of vitamin C, and vitamin C can make potassium permanganate solution fade. The more vitamin C content, the less drops needed to fade potassium permanganate. According to this feature, we can determine which vegetables or fruits have high vitamin C content.

The experimental steps are as follows: firstly, Potassium permanganate solution prepared by the same volume is poured into a transparent cup. Secondly, take a certain amount of clean vegetables and fruits and grind them in a mortar, then filter them with gauze to get vegetable juice or fruit juice for reserve. Thirdly, drip vegetable or fruit juice into it with a plastic head dropper and shake it until the potassium permanganate solution fades completely. Lastly, record the number of drops added and compare them, then draw a conclusion.

By exploring the common vegetables and fruits in daily life, we can teach students chemistry knowledge from experiments closely related to life. It can not only attract students' attention and interest, but also make it easier for students to accept knowledge. Let students know that chemistry is related to life. Chemistry is indispensable to everyday life. It can change students' prejudices about past chemistry cognition.

**Testing of Friction Agents in Toothpaste**

To let students more clearly understand the close relationship between chemistry and human life, and know that people's clothing, food, housing, transportation are inseparable from chemistry in all aspects. In teaching, teachers should try to connect the chemical knowledge in books with daily life. The closer the content is to daily life, the more they can arouse students' enthusiasm and interest in learning. Therefore, knowledge will not be exhausted unless it is drawn from life and used for life. Only by keeping pace with the times can knowledge be continuously updated. The purpose of this
experiment is to make students understand the efficacy of some components in toothpaste and to know how toothpaste protects gums by exploring the use of toothpaste in daily life, to improve students' observation and hands-on ability. Its aim is also to let students experience the joy of experimental food and the charm of chemistry in the process of doing experiments by themselves, so as to cultivate students' interest in chemistry.

The main ingredient in toothpaste is friction agent, which is used to brush down the food, dirt and plaque remaining in the teeth. Friction agent is a kind of material that can exert friction effect, but it will not hurt teeth at the same time. Friction agents in toothpaste are usually composed of calcium carbonate and silica, which together account for more than half of the components of toothpaste. If there is only one friction agent in toothpaste, now let's examine what kind of friction agent is in toothpaste. The experimental steps are as follows: Take a small amount of toothpaste into a transparent cup, then add excessive dilute hydrochloric acid to it, then stir it with glass rod continuously, and finally observe the experimental phenomena. Compare the experimental phenomena below, and then determine which substance the friction agent is.

The experimental conclusion is that silica does not react with hydrochloric acid, calcium carbonate reacts with hydrochloric acid accompanied by gas formation, and aluminium hydroxide reacts with hydrochloric acid and other acids.

Another experiment is testing for glycerol in toothpaste. Generally, the lubricant in toothpaste is glycerin, which has the function of keeping the toothpaste wet and gums. The chemical composition of glycerol contains three hydroxyl groups, and the reaction of polyhydroxyl compounds with the new copper hydroxide solution produces a blue solution. Glycerol in toothpaste can be determined by observing the color change of the solution. The experimental steps are as follows: Take a small amount of prepared toothpaste samples into a transparent beaker, then add a proper amount of distilled water to it and stir it with glass rod to dissolve it fully. Set aside, take the supernatant and then drop the new copper hydroxide solution into it. Then observe the experimental phenomena. The experimental conclusion is if the blue solution is produced, the toothpaste component contains glycerol. Without blue solution, toothpaste does not contain glycerol. As are shown in Figure 3.

![Figure 3](image3.png)

**Figure 3.** Reaction of toothpaste with fresh copper hydroxide solution.

Another experiment is testing for acidity and alkalinity of toothpaste. The experimental conclusion is if the blue solution is produced, the toothpaste component contains glycerol. Without blue solution, toothpaste does not contain glycerol. As are shown in Figure 4.

![Figure 4](image4.png)

**Figure 4.** Determination of acidity and alkalinity of toothpaste.
Determination of acidity and alkalinity of toothpaste solution. The experimental steps are as follows: the pH test paper was placed in the prepared glassware, which is shown in Figure 4. The prepared toothpaste was dipped in the water-soluble supernatant with a glass stick and compared with the standard colorimetric card. Conclusions are that toothpaste is alkaline if pH > 7, acidic if pH < 7 and neutral if pH = 7. Toothpaste should not be too diluted, and as far as possible reduce the amount of reagents, reflecting the concept of green chemistry.

Summary

Our institute carries out interesting chemistry laboratory, making full use of the advantages of school educational resources, and carries out independent experimental teaching reform to enhance the cultivation of teaching skills of normal students, at the same time, it can also cultivate students' innovative ability in experimental design and reform. In view of the current development trend of China's education and under the requirements of the new curriculum standard, more attention should be paid to the cultivation of quality education, which is also the inevitable trend of curriculum reform in Colleges and universities, requiring the cultivation of a large number of compound talents to meet the needs of the times.

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