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The Cultivation of Green Chemistry Literacy in Vocational Colleges

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Abstract: *Improving green chemistry literacy is an educational direction, which is a sign of students' quality improvement, and the intellectual support for the continuous progress of social civilization. In view of the lack of green chemistry literacy in vocational colleges, the cultivation plan of green chemistry literacy in vocational colleges is formulated. In the course of teaching, the cultivation plan of green chemistry literacy is implemented, and the effect of green chemistry literacy cultivation is tracked and analyzed.*

Keywords: *Vocational colleges, Green chemistry Literacy, Cultivation*

1. Purpose and significance of the research

Huang Yanpei believed that "Only teaching students occupation, but paying no attention to the cultivation of spirit is a kind of ‘instrumental’ education". Vocational colleges are places to train high-quality workers, so while teaching chemistry knowledge, consciously cultivating students' green chemistry awareness and improving green chemistry literacy[1] can not only improve students' comprehensive quality and professional literacy, but also help them establish green development concept and enhance environmental awareness and social ethics.

In view of the serious lack of green chemistry literacy in vocational college students, the cultivation plan of green chemistry literacy in vocational colleges is formulated. In the course of teaching, the cultivation plan of green chemistry literacy is implemented, and the effect of the plan is tracked and analyzed.

In order to cultivate students' green chemistry literacy, chemistry teachers should first learn green chemistry knowledge, establish their own view of green chemistry, and improve their own green chemistry literacy. Secondly, the green chemistry education should be widely carried out in vocational colleges and universities, and the leaders of all majors should be called on to revise talent training program and incorporate the chemistry course into the talent training program of all majors.

2. Investigation and statistics on the status quo of green chemistry literacy in vocational colleges

The concept of green chemistry has been introduced into our country for more than 30 years. What is the status quo of green chemistry literacy cultivation among vocational college students? With this problem in mind, we made a questionnaire and distributed it among students majoring in mechanical design and manufacturing, architectural engineering technology, electrical automation technology, pharmacy, drug management and management, intelligent construction, and wisdom health care in various vocational colleges in Tengzhou, Zaozhuang so as to understand the status quo of green chemistry literacy education in various vocational colleges in Zaozhuang. The questionnaire was widely distributed. Many professions are involved, and the problems reflected are representative to a certain extent. The statistical results of the questionnaire are shown in Table 1.

1) Almost all students can correctly understand the meaning of the word "green" in green food and green production, but only 8.6% understand green chemistry through teachers' explanation, and 78.5% have never heard of green chemistry. This shows that in vocational colleges, most chemistry teachers only attach importance to the teaching of chemical knowledge, and rarely mention green chemistry in class, let alone expand the content of green chemistry, and green chemistry knowledge has not been well publicized and popularized.

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2) 80% of the students care about the surrounding environment in which they live, and 93.5% of the students believe that learning chemistry well helps to enhance their environmental awareness and protect the environment; 91.5% of the students believed that chemistry courses should be offered in vocational colleges, and 86.0% of the students believed that it was necessary to cultivate green chemistry literacy for students in vocational colleges. This shows that vocational college students are eager for chemical knowledge and desire to improve their own green chemical literacy.

3) 82.8% of the students believe that from the beginning to control the use and emission of production and domestic pollutants is the most economical and effective way to protect the environment, which shows that vocational college students have good ideological consciousness. A little instruction to inspire green concept can help them establish "green consciousness" and form a conscious action to protect the environment.

4) 86.7% of the majors do not offer chemistry courses, and only 13.3% of the majors such as pharmacy, pharmaceutical management and management offer chemistry courses. Some of the students in vocational colleges come from spring college entrance examination. For these students, they only have a one-year chemistry study in the third year of junior middle school. Some students have not even finished the chemistry study, so they have not got the rudiments of chemistry knowledge. The other part of the students come from summer college entrance examination, but most of the majors in vocational colleges are both liberal arts and science, so nearly 50% of the students did not choose to study chemistry in high school, which means that these students just started or learned some of the most basic chemistry knowledge in the first year of high school, which is far from enough for their subsequent study, work and life. This means that they know little about chemistry, let alone green chemistry, and their lack of green chemistry literacy is extremely serious for them.

Table 1: Statistical Results of the Questionnaire

Choices Percentage of Answers Number and contents	A	B	C
1.Does your major offer chemistry courses?	No 86.7	One semester 0	One year 13.3
2.Have you ever heard of green chemistry?	Never 78.5	Occasionally 20.0	Often 1.5
3.What does "green" mean in green food and green production?	Harmless to human health and the environment 100	Green 0	Relatively clean 0
4. Which country first proposed the concept of green chemistry?	USA 16.1	China 45.2	Japan 38.7
5. How did you learn about green chemistry?	Teacher introduction 8.6	Newspapers and magazines 21.5	Other modes 69.9
6. Do you care about the environment you live in?	It does not matter 20.0	Occasionally care about 51.5	Very concerned 28.5
7. Do you know the top ten environmental problems facing the world?	Hardly know 21.0	Generally know 66.0	Can list one by one 13.0
8. Do you think studying chemistry is related to protecting the environment?	Closely related 24.7	Has a certain relationship 68.8	No relationship 6.5
9. Which of the following measures to protect the environment do you think is more economical and effective?	Prevention from the beginning of production and life 82.8	Carryout comprehensive management 15.1	Do not use chemicals, return to nature 2.1
10. What do you think is the long-term goal of environmental protection?	Everyone has environmental awareness and environmental protection ability 38.0	Publications vigorously promote 21.5	Radio and television media 40.5
11. In your opinion, how to protect the environment during the experiment?	Control from the beginning 73.1	Process Control 14.0	Terminal control 12.9
12. Do you think it is necessary to offer chemistry courses in vocational colleges?	Doesn't matter 8.5	Necessary 57.5	Very necessary 34.0
13. Do you think it is necessary for vocational college students to develop green chemistry literacy?	Necessary 86.0	Not necessary 5.4	Don't know 8.6

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In short, most chemistry teachers only pay attention to the teaching of chemical knowledge, and rarely mention green chemistry in class, let alone expand the content of green chemistry, and the knowledge of green chemistry has not been well publicized and popularized. In addition, most majors do not include chemistry in their talent training program, resulting in the suspension of chemistry classes, so vocational college students lack green chemistry literacy seriously.

3. Cultivation plan of green chemistry literacy in vocational colleges

3.1 Infiltration of greenization in classroom teaching to cultivate students' green chemistry literacy

At present, there are still few chemistry textbooks related to green chemistry knowledge, which requires chemistry teachers in vocational colleges to timely replace new textbooks, or form a team to write chemistry textbooks interspersing green chemistry knowledge, or collect green chemistry related knowledge and production technology through various channels in the teaching process, and consciously intersperse them in classroom teaching. Make classroom teaching permeate green chemistry literacy so as to cultivate students' green chemistry literacy,[2] such as green chemistry problems in food, green chemistry problems in daily necessities, indoor green chemistry problems, green chemistry problems in medicine, etc. These life examples will be interspersed in the classroom teaching, so that students can seriously think about green chemistry problems contained in them.

For example, polylactic acid’s excellent biocompatibility can be used as medical sutures. Polylactic acid is non-toxic. The degradation product of lactic acid in the body can involve in metabolism, and can be used as a drug sustained release carrier and orthopedic surgery fixation material.[3]

3.2 Highlighting greenization in chemical experiments to cultivate students' green chemistry literacy

The conventional experiments in teaching materials are redesigned, reformed and assembled to reduce the amount of reagents and the generation of "three wastes" as much as possible under limited conditions. Or in the premise of no consumption of chemical reagents, make use of computer-aided experiments, virtual simulation demonstration and other means to vividly simulate the whole process of the experiment.[4] In the experimental design concept, zero pollution and zero emission are put in the first place,[5] highlighting the greenization of chemical experiments.

For example, when potassium dichromate method is used to measure the iron content in iron ore, there are two types of pretreatment methods for the sample: First, there is mercury iron method, that is, excessive SnCl2 is added to the sample solution after acid dissolution, and after Fe3+ is all reduced to Fe2+, HgCl2 is used to remove the remaining SnCl2, but this method will pollute the environment. The second is the mercuryless iron measurement method, that is, in the pre-reduction stage of the sample after acid dissolution, sodium tungstate and silicon-molybdenum yellow are used as indicators, TiCl3 and SnCl2 are used as titrators, and the solution is titrated until the solution is blue, that is, "tungsten blue" and "silicon-molybdenum blue", which also achieves the sample pretreatment effect, but reduces the pollution to the environment.

3.3 Integrate greenization into the explanation of exercises to cultivate students' green chemistry literacy

When explaining exercises, deliberately select or write some exercises related to green chemistry in production and life, and explain the importance of cultivating green chemistry literacy with numbers through analysis and calculation.

For example, a factory needs 20,000 tons of 0.5% sulfur coal per month to generate electricity, and how many kilograms of SO2 are contained in the exhaust gas emitted each month? If the coal is desulfurized before power generation, how many kilograms of sulfur can be recovered per year? How many kilograms of ammonium sulfide can be produced?[6]

3.4 Deepening greenization in extracurricular activities and cultivating students' green chemistry literacy

Weekends and extracurricular activities allow students to get out of the chemistry class, carry out "green action",[7] and consolidate and expand the chemistry knowledge learned in class in practical life. For example,

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3.4.1 Discuss the topic of halogen compounds and human health

To consolidate and review the knowledge of halogens and their compounds, students should look up the relationship between fluoride and human health and the relationship between iodine compounds and human health. Understand the importance and mechanism of fluoride and iodide to human health, and the harm caused by excessive fluoride and iodide. Learn about the effects of fluoride toothpaste and how to use these products properly.[8] Then the materials collected by the students are summarized, and the first thing is to communicate in the class, and then the information is posted in the chemistry and life garden opened in the classroom, and in the form of blackboard newspaper on campus for other students to read.

3.4.2 Discuss the topic of environmental pollution and resource conservation

When explaining organic chemistry, in order to let students understand the current environmental pollution status (such as white pollution, air pollution, river pollution, etc.), let students go out of the campus on weekends to observe and photograph the pollution of the surrounding river, the air quality status in the evening, and organize students to visit the nearby water company to understand the treatment process of domestic water. Through the above investigation activities, students have a personal experience of the current environmental pollution on production, life and health hazards.

3.4.3 Discuss the topic of waste battery recycling

When learning the chemical power supply and new batteries in the chapter of the principle and application of galvanic batteries, the students are shown in the form of a circular graph using multimedia: a button battery and the amount of water polluted.[9] After that, it suddenly dawned on students that the harm of the batteries we often use and discard at will is so great! Questions are then asked to guide students to think about how to dispose of used batteries. At this point, the students say that in the future, they will no longer throw waste batteries, and they will establish waste battery recycling bins in our school.

In addition, we can also start from the ozone hole, acid rain, climate anomaly (El Nino phenomenon), Marine pollution, resource shortage, new energy development and other environmental[10] and energy issues facing the world, and call on them to take the initiative to promote green environmental protection knowledge, affect people around them with practical actions, and form a good sense of social ethics.

4. The implementation effect of the cultivation program of green chemistry literacy

The pilot class of the college where the author works has achieved good teaching results. The student feedback are the following:

The first is to make students realize that chemistry is closely related to the environment. Know the harm to the environment caused by used batteries and white waste. Know the characteristics of common metals and the harm to the human body after light metals, heavy metals and heavy metals are absorbed by human body in daily life. It is known that oil will produce greenhouse effect in the process of use and cause harm to the environment. The green environment depends on everyone. Starting from the smallest, the natural environment will become better and better. The second is to let students realize that chemistry is closely connected with life production, such as shopping, diet, hygiene, health, medicine and so on. Life and production are inseparable from chemistry, which inadvertently pollutes air and water resources. In the future, people should do as much as possible to publicize and protect the environment, so that future generations can continue to live on the earth and make their lives better! Chemistry allows us to understand the reactions between substances, the properties of metals, and even the tricks in our lives. In the new world of the 21st century, we should learn chemistry, and use chemistry to solve some problems that are hard to be solved in life. Third, let students experience the fun of learning chemistry. Chemistry is an interesting course that allows people to master knowledge in happiness and experience the mysteries of nature. Now learning chemistry is like playing games as a child, which is no longer as boring as that in middle school.

5. Conclusion

It is imperative to carry out green chemistry education in vocational colleges chemistry teaching, which needs more chemistry educators to get into this work, so that green chemistry education can

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become a reality. We look forward to cultivating our students into skilled talents with green consciousness through green chemistry education, so that no matter what kind of occupation they will engage in in the future, they will have certain environmental knowledge, higher environmental awareness and environmental ethics, and become "green citizens".

The author believes that the green seeds planted must take root and germinate in the minds of students and affect the people they come into contact with. Through the joint efforts of the majority of chemistry educators, the cultivation of green chemistry literacy in vocational colleges will continue in an orderly manner, and more and better high-quality skilled talents will be trained for the development of society, the country and the regional economy.

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