



Preliminary Knowledge Analysis of First-Year Undergraduate Student at UIN Walisongo on Green Chemistry Concept

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Abstract: Preliminary Knowledge Analysis of First-Year Undergraduate Student at UIN Walisongo on Green Chemistry Concept. Green chemistry is a form of application of chemistry in reducing or minimizing environmental problems. The implementation of green chemistry in education aims to increase student awareness of the environment, especially early-level students (students in semesters 1 and 3). This study aimed to analyze the knowledge of the green chemistry concept of early-level students of the Chemistry Education Study Program at UIN Walisongo Semarang. The research method used is a qualitative descriptive method. Respondents from the study were early-level students of the Chemistry Education at UIN Walisongo Semarang, totaling 52 people. The selection of respondents was based on the fact that the students of that class had already received a Chemistry Education course for Sustainable Chemistry, which included applying the concept of green chemistry. The average result of the study was 84%, with a positive response. The study results can be used as a reference for further research.

Keywords: green chemistry, sustainable development, first-year undergraduate students.

Abstrak: Analisis Pengetahuan Awal Mahasiswa Tahun Pertama di UIN Walisongo tentang tentang Konsep Kimia Hijau. Kimia hijau adalah bentuk penerapan kimia dalam mengurangi atau meminimalkan masalah lingkungan. Penerapan green chemistry dalam pendidikan bertujuan untuk meningkatkan kesadaran mahasiswa terhadap lingkungan, khususnya mahasiswa tingkat awal (mahasiswa semester 1 dan 3). Penelitian ini bertujuan untuk menganalisis pengetahuan konsep green chemistry pada mahasiswa tingkat awal Program Studi Pendidikan Kimia UIN Walisongo Semarang. Metode penelitian yang digunakan adalah metode deskriptif kualitatif. Responden penelitian ini adalah mahasiswa tingkat awal Pendidikan Kimia UIN Walisongo Semarang yang berjumlah 52 orang. Pemilihan responden didasarkan pada fakta bahwa siswa kelas tersebut telah mendapatkan mata kuliah Pendidikan Kimia untuk Kimia Berkelanjutan, yang termasuk dalam penerapan konsep green chemistry. Hasil rata-rata penelitian adalah 84%, dengan respon positif. Hasil penelitian tersebut dapat dijadikan sebagai acuan untuk penelitian selanjutnya.

Kata kunci: kimia hijau, pengembangan berkelanjutan, mahasiswa tahun pertama.

▪ INTRODUCTION

Knowledge is the result of human sensing, namely the result of someone's curiosity about objects through their senses (eyes, nose, ears). The results of human sensing to become knowledge are strongly influenced by the intensity of attention and perception of the object (Majid, 2011). Most of a person's knowledge is obtained through hearing (ears) and the sense of sight (eyes). Because the concept of knowledge is to be able to define something transparently and clearly so that the desired knowledge can be achieved and can explain existing phenomena (Rachman, 2018). Knowledge is a collection of knowledge that comes from the activity of "knowing" which is essentially part of a person's need to make him know (Dafrita, 2015). When human curiosity is introduced, then knowledge can be implemented in various institutions, one of which is education, then knowledge can be said to be something real (Nasir, 2021). Several factors can influence human knowledge, one of which is formal education. Knowledge is related to education, whereas higher education will have more comprehensive knowledge. However, it should be emphasized that it does not mean that someone with low education has lower knowledge. A person's knowledge of an object contains two aspects, positive and negative aspects. These two aspects will determine a person's attitude. The more positive aspects and objects known, the more positive attitudes will be towards certain objects (Wawan and Maria, 2010).

Green chemistry is a form of application of chemistry in reducing or minimizing environmental problems and that which has demonstrated benefits for the environment and functionality of products and processes can be realized while reducing the negative impact (Zimmerman et al., 2020). One of the concepts of green chemistry is using renewable raw materials that do not pollute the environment to increase energy efficiency and reduce the toxicity of an object (Ramdhaniah, Sari and Farida, 2021). The research results state that applying the concept of green chemistry in overcoming the negative impacts of the use of fuel oil is more environmentally friendly and produces non-polluting combustion (Pramitha et al., 2016).

The application of the concept of green chemistry aims so that humans can protect the universe by not causing damage to the earth. So that the earth that is used as human habitation always feels comfortable, safe, and peaceful. Green chemistry aims to introduce new technologies that will change the properties utilization and synthesis of chemicals. Transformation this technology is rare but never happened before. For example, the Haber-Bosch process for atmospheric nitrogen turns into ammonia become a sustainable feedstock for nitrate, reduce the use of nitrates minerals that are mined and can damage the environment. Green chemistry it is not only profitable but makes the materials used have economic value (Poliakoff et al., 2009).

The implementation of green chemistry can be applied in education. The implementation aims to increase student awareness of the environment, especially early-level students (semesters 1 and 3). Green chemistry-*oriented* education can help students solve environmental problems (Ichsan et al., 2018). Students can analyze problems directly and transparently by looking at the conditions around the environment. Increased awareness of the environment among students must be based on their awareness and knowledge of the concept of green chemistry. One of the green chemistry *concepts* that can be applied in education includes waste prevention, atomic economy, energy efficiency, alternative energy, catalysis, process step reduction, *degradable product design, and real-time* analysis for pollution prevention.

The concept of green chemistry is also related to the *Sustainable Development Goals* (SDGs) program in the Chemistry Education for Sustainable Development course. This course studies how chemistry education supports ending global issues, especially the current environmental crisis based on the *Sustainable Development Goals* (SDGs). This is related to the concept of green chemistry, which is very concerned about environmental sustainability. It is important to analyze the student's knowledge about green chemistry based on these problems. This study aims to analyze the *knowledge* of early-level students of the Chemistry Education Study Program at UIN Walisongo Semarang on green chemistry concept. It is hoped that the results of this study can be used as a reference for further research.

▪ **METHOD**

The research method used is a survey method and qualitative description (Creswell, 2012). The research implementation activities include:

a. Making Research Instruments

An instrument is a tool used to test (Bariah, 2019). The research instrument used was a questionnaire in a *google form*. The selection of *google forms* is based on the fact that the platform is easy to use, easy to access (Maulidiansyah, 2018), supports online data search and is familiar among students. The instrument designed contains several questions related to the concept of green chemistry with a rating scale of 1-5 (strongly disagree - strongly agree). Some of these questions include:

1. Do you know about the concept of green chemistry?
2. Do you know about the 12 principles of green chemistry?
3. Is it important to apply green chemistry in everyday life?
4. Is the concept of green chemistry *effective* in Indonesia?
5. Is it feasible that the concept of green chemistry *is* applied in learning?
6. Is it important for the concept of green chemistry to be applied in various Universities in Indonesia?
7. Can the principles of green chemistry be used to support *sustainable development*?
8. Do you apply the concept of green chemistry in your daily life?

b. Disseminate Research Instruments

The instruments that have been made are then distributed to the respondents. The respondents in this study were Chemical Education students batch 2020 and 2021 at UIN Walisongo Semarang, totaling 52 people. The selection of respondents was based on the fact that the students of this class had already received a Chemistry Education course for Sustainable Chemistry, which included applying the concept of green chemistry.

c. Research Findings Data Processing

The questionnaire consisting of 8 questions with options 1-5 indicating strongly disagree-strongly agree from the respondents obtained an average of 84% which was then processed using Microsoft Excel. The data analysis process used in this study analyzed student responses. Analysis of student responses from the results was processed using the formula: Analysis of student responses from the results is processed using the formula:

$$\text{Student response (\%)} = \frac{\text{Obtained score}}{\text{Maximum score}}$$

The student response categories are based on Table 3 below. Student responses are declared positive if the average score of positive responses obtained is 75%.

Table 1. Category Interpretation of Student Responses Based on the Gutman Scale

Average score (%)	Category
85-100	Very positive
70-84.9	Positive
55-69.9	Pretty positive
40-54.9	Less positive
25-39.9	Not positive

▪ RESULT AND DISCUSSION

a. Questionnaire Data

The resulting data is survey data from 52 respondents. The resulting data was then analyzed using *Microsoft Excel* and interpreted qualitatively. The following are the results of the questionnaire from 52 respondents:

Table 2. Results of the questionnaire

Question	Average response (%)
Do you know about the concept of green chemistry?	82%
Do you know about the 12 principles of green chemistry?	73%
Is it important to apply green chemistry in everyday life?	92%
Is the concept of green chemistry effective in Indonesia?	83%
Is it feasible to apply the concept of green chemistry in learning?	90%
Can the principle of green chemistry be used to support sustainable development?	91%
Is it important to apply the concept of green chemistry in various universities in Indonesia?	91%
Do you apply the concept of green chemistry in your daily life?	68%
Average	84%

To support students' knowledge regarding the concept of green chemistry, the Chemistry Education for Sustainable Development (PKPB) course is available. The following questions are asked for the questionnaire:

Question 1: Do you know about the concept of green chemistry?

Green chemistry reduces and eliminates harmful compounds in chemical processes or products (Ulfah, Rahayu and Dewi, 2013). The purpose of green chemistry is to create processes or chemical products that are environmentally friendly so that they do not harm the environment. The average result of the study was 82%. This shows that

the respondents answered very positively, so it can be concluded that the respondents have knowledge of the concept of green chemistry.

Question 2: Do you know about the 12 principles of green chemistry?

Green chemistry has 12 principles that are expected to be used to solve problems in the environment. These principles include (Al Idrus et al., 2021) prevention of waste in production, design of a harmless chemical process, design of a safe synthesis process, use of renewable raw materials, use of catalysts, reducing derivatization, maximizing atomic economy, using safe solvents, energy efficiency in a reaction, design easy chemical processes degraded, as well as minimizing the potential for accidents. The average data of the research results is 73% which shows a positive response. This shows that the respondents' knowledge is still relatively low in knowing the 12 principles of green chemistry.

Question 3: Is it important to apply green chemistry in everyday life?

The average research result is 92% which shows a very positive response. According to the respondents, *the results showed that* green chemistry is important in everyday life. Applying green chemistry in everyday life is helpful in protecting the environment from all pollution or anything that can damage it.

Is the concept of green chemistry effective in Indonesia?

The results obtained an average of 83%, which shows a very positive response. Based on applying the concept of green chemistry, namely as a solution in solving environmental problems, especially in Indonesia. According to (Sriyanto, 2007), the current environmental problems have entered into quite a dilemma, complex, and attention-grabbing problem. Currently, Indonesia intensively promotes the development and economic growth utilizing natural resources. However, the program's implementation leaves a negative impact on environmental sustainability, such as the excessive use of chemicals, poor waste management, widespread use of fossil energy, and others. Thus, applying the concept of green chemistry in Indonesia is very important to minimize environmental damage that occurs. This is in line with the study results, which showed that respondents considered the application of the green chemistry *concept* in Indonesia to be very effective.

Is it feasible to apply the concept of green chemistry in learning?

The average data from the study results of 90% showed a very positive response. This shows that respondents agree if green chemistry *is* applied in learning. When students apply green chemistry in learning, it is hoped that this will always be brought to the community (Wahidah et al., 2021).

Can the principle of green chemistry be used to support sustainable development?

Sustainable development is a planned effort for a benefit in the present to the future. Sustainable development in its implementation process continues to prioritize preserving raw materials or natural resources and not depleting natural resources. Sustainable development is a crucial issue at this time, given the increasingly damaged environmental conditions (Wahyuningsih and Rohmah, 2017). The research results from respondents obtained an average of 91%, which indicates that respondents agree that green chemistry can support the concept of sustainable development. Green

chemistry in its application always maintains environmental balance to support sustainable development.

Is it crucial to apply the concept of green chemistry in various universities in Indonesia?

The application of the concept of green chemistry is crucial in education, especially on campuses. The goal is to foster a caring attitude of students as *agents of change* in world civilization towards the environment. 91% of respondents' data shows that respondents consider it important if green chemistry applies in various universities.

Do you apply the concept of green chemistry in your daily life?

Based on the data obtained by 68%, the respondents have not maximized the application of the concept of green chemistry in their daily lives. This is due to their lack of awareness and knowledge in understanding the concept of green chemistry. Applying the concept of green chemistry has a good influence on human life and the environment.

▪ CONCLUSION

Preliminary knowledge analysis of early-level students at UIN Walisongo on the concept of green chemistry is positive, with an average of 84%. The data obtained from the research shows that the early-level students of UIN Walisongo already have relatively high knowledge of the concept of green chemistry. However, this must continually be improved to achieve better learning objectives.

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