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Analysis of Basic Level Students' Knowledge of Hazardous and Toxic Waste

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Abstract – *Hazardous and toxic waste (B3 waste) is defined as waste that contains harmful and toxic substances, so that it can directly or indirectly damage the environment, disrupt health and threaten the survival of humans and other organisms. Students' awareness of B3 waste management can be seen through the level of knowledge they have. The level of knowledge is important in shaping a person's attitude or behavior towards the surrounding environment. The purpose of this study is to find out how much information or knowledge is owned by students of Sebelas Maret University (UNS) related to B3 waste management. The data analysis method used in this study is a descriptive analysis method in the form of a desriptive explanation of the data obtained about uns students' knowledge of B3 waste. The data collected in the form of primary data is conducted through interviews and questionnaires and secondary data. The results showed that the knowledge of Sebelas Maret Student University students related to B3 waste management is quite good, it can be seen through the results of questionnaires and interviews where there are 38 who already know and understand about B3 waste supported by the answers of 45 respondents who already understand the B3 waste itself, and there are 41 respondents who already know how they process B3 waste, namely by handing over B3 waste to the sewage treatment plant.*

Keywords *–Students' knowledge, hazardous and toxic waste, hazardous and toxic waste management.*
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1. Introduction

Waste can be interpreted as waste or waste produced from various human activities. One type of waste that is able to pollute and endanger the environment is hazardous and toxic material waste or in short commonly called B3 waste (Suwandi et al., 2019). B3 waste itself is generally interpreted as waste that contains harmful and toxic substances, so that it can directly or indirectly damage the environment, disrupt health and threaten the survival of humans and other organisms (Sidik et al., 2018). B3 waste is corrosive, explosive, easily oxidized, easily lit, contains toxins, causes irritation and can also cause health symptoms such as carcinogenic and mutagenic (Herawati et al., 2021). B3 waste with corrosive properties can cause irritation to the skin, cause staining in steel, has a pH of ≥ 2 (when acidic) and a pH of ≥ 12.5 (if alkaline). Examples of B3 waste with corrosive characteristics include residual sulfuric acid used in the steel industry, acid waste from batteries and accu. B3 waste that is easily explosive is a waste that has a standard temperature and pressure or can also explode due to the presence of gases with high temperatures and pressures produced through simple physical or chemical reactions (Sopiah and Aviantara, 2019). This waste is very dangerous both when handling, transporting, and disposal because it can cause large explosions unexpectedly. As for examples of B3 waste with explosive properties such as explosive material waste and laboratory waste such as prikat acid. Then, for waste that is easily oxidized, it has the potential to cause fire when reacting with other materials. This waste if not treated seriously can cause large fires in the ecosystem. Examples of B3 wastes with oxidizing properties such as chlorine. Furthermore, waste that has easy-to-light properties can arise due to contact with air, flame, water, or other materials even in standard temperature and pressure. Examples of B3 waste that is easy to light for example benzene solvents, acetone solvents derived from the paint, ink, and others industries. Next there is toxic waste that contains substances that are toxic to humans or animals, so it can cause poisoning, illness, or death either through respiratory, skin, or mouth contact. Examples of this b3 waste are agricultural waste such as pesticide waste. Then, the last is the carcinogenic waste properties that are waste

that can cause the onset of cancer cells (Spencer, 2021). Therefore, special management of B3 waste is needed to prevent and reduce the risk of pollution and environmental damage (Robot dk., 2019). Based on Pp Ri No. 101 of 2014, it is mentioned that every party that produces B3 waste must conduct B3 waste management and must be responsible ranging from the waste produced to destroyed (Kurniawan, 2019). The stages or hierarchy of B3 waste management include storage and collection, utilization, transportation, management, and hoarding (Purba et al., 2019). Some parties related to B3 waste management activities include B3 waste producers, waste collectors, waste carriers, waste utilization, waste processing and waste hoarders (Fajriyah and Wardhani, 2020).

Students are generally seen as agents of change who will be able to bring change and become an example in the community (Masruroh, 2018). Students also have a critical nature, sensitive, and concerned about the problems that occur in the surrounding environment, so students are considered to have a big role in the changes that occur in the environment. These attitudes can be seen from how they care about the waste or waste they produce. Especially, for students whose lives are traveling are required to live independently, so this can be a benchmark of land and knowledge for every student against the B3 waste they produce. At the Sebelas Maret University(UNS), generally regional students prefer to live in the index which of course in their daily activities produce waste or waste (Ulimaz et al., 2021). One of the wastes produced is B3 waste, for example such as clothing detergents, floor cleaners, battery stones, used cosmetic containers, and others. The level of awareness of UNS students towards B3 waste can be known through their level of knowledge of B3 waste itself. In this case, the level of knowledge is important in shaping a person's attitude or behavior towards the surrounding environment. Although actually the knowledge that a person has regarding environmentally friendly behavior does not guarantee that one will apply such behavior in everyday life. However, in this case knowledge remains important to be disseminated in order to form a younger generation that behaves environmentally friendly. Therefore, this study aims to find out how much information or knowledge is owned by students of Sebelas Maret University related to B3 waste management.

2. Materials and Methods

This research was conducted at Sebelas Maret University located at Jl. Ir. Sutami, Kentingan, Jebres Subdistrict, Surakarta, Central Java. The study was conducted from October 23, 2021 to November 19, 2021. The data collected is in the form of primary data that includes UNS students' knowledge of B3 waste management and secondary data that includes supporting journals related to B3 waste, B3 waste management, and so on. Primary data collection is done through the dissemination of questionnaires and interviews to several UNS students. The number of samples used in this study was 48 respondents. The equipment used in the study was stationery, laptops, and questionnaires. As for the material used in this study in the form of journal references and tally sheets. The data analysis method used in this study is a descriptive analysis method in the form of a desriptive explanation of the data obtained about uns students' knowledge of B3 waste. Some of the research stages conducted are:

1. Preparation is to prepare everything needed in conducting research.
2. Determining the location of the research, namely determining the location that will be used as a place of research. The location we chose was Sebelas Maret University. The reason we chose this location was because it was in accordance with the title and object of research that we wanted to analyze.
3. Conducting research through interviews and questionnaires, both of which aim to obtain information related to awareness and knowledge known by Sebelas Maret University students regarding B3 waste.
4. Analyzing the data that has been obtained, this is done to determine the entanglement between the data collected and the research objectives which will later be presented in the discussion and followed by conclusion

3. Result and Discussion

3.1. B3 Waste In General

B3 waste is the rest of the business or residue from activities that contain toxic substances that can be produced by various sources such as settlements (household waste), hospitals, factories, and various other sources (Mahbubah et al., 2020). This waste can indirectly damage the environment can interfere with health and threaten the survival of humans and other living things in the area around the waste disposal area, so special management is needed on B3 waste. B3 waste management is important to be known by people of all ages, both young and old. If everyone understands and knows about B3 waste, the dangers posed, and how it is managed then it can certainly help prevent pollution caused by B3 waste itself. If every individual is indifferent and does not understand the dangers posed by B3 waste, then the potential for B3 waste to endanger human health and pollute the environment will be higher. Adverse effects caused include disruption of the respiratory and digestive systems in humans, organ damage in humans (lungs, liver, and other organs), and other adverse effects. Meanwhile, other living things such as animals and plants can be exposed to toxins due to food chains that are damaged and poisoned by B3 waste. In addition to disturbing health, B3 waste is also able to harm humans, considering its explosive and flammable nature.

Some of the things that can be done by the producer of B3 waste generation include identifying B3 waste (including in what type of waste, what category, recording the type and volume of B3 waste and conducting advanced management data collection (whether used as other products or need self-processing or need processing assistance from the 3rd

party). If the waste producing party does not have a B3 waste management permit, it will generally be handed over to a third party. Some of the activities carried out are:

1. Collectors, with collection records are prohibited from utilizing and/or processing B3 waste against any part or all B3 waste collected (because the permit is only as a collector only), it is prohibited to hand over B3 waste collected to other B3 waste collectors and prohibited from mixing with other B3 wastes
2. Utilization / processor / hoarder must be done by someone who has a valid permit, has a permit in accordance with the type of waste managed, and has a cooperation contract with the producer
3. B3 waste carrier must be carried out by someone who has permission from the Ministry of Transportation and recommendations from klhk, then the waste transported in accordance with the recommendations, conveyances used in accordance with recommendations / permits and transportation areas in accordance with recommendations / permits
4. The use of manifests, with the flow of Manifest distribution of B3 waste starting from waste produced by the producer or collector of B3 waste which is then handed over to the carrier and then handed over to the collector / processor / utilization / hoarder. Manifest number 6 (cream) will be sent to DLH Province, manifest number 4 (pink) will be sent to collector or processor, manifest number 5 (blue) will be sent to KLHK, and manifest number 7 (purple) will be sent back to the producer after going through a long enough process for the producer to have a valid B3 waste treatment process document. Furthermore, manifest number 3 (green) will also be stored by waste producer B3, manifest number 2 which (yellow) will be sent to Bapedal or KLHK and the last manifest number 1 (white) will be stored by the carrier as proof of travel. With this B3 waste manifest document, all parties will have clear B3 waste management data for carriers, Bapedal / KLHK, waste producers, collectors, provinces and other parties.

3.2. B3 Waste Classification

Waste classification is divided into 3, namely: based on its characteristics, based on the source of the pollutant, and based on its chemical properties.

a. Based on its characteristics

The characteristics or forms of waste are classified into liquid, gas/particle and solid, and can be recognized and identified with the eye directly.

1. Liquid: Waste liquid is waste that have the shape of liquid that comes from various activities and can pollute the environment when disposed of in the environment.
2. Gas/Particle: Gas/particle waste can be in the form of gas/smoke, particulate, or dust, which is released from various activities. This waste is easily carried by the wind so that its impact on the environment is wider than other wastes.
3. Solid: Solid waste is waste in the form of solids, mud, or slurry that comes from the remnants of various activities. Some solid waste can be recycled, some cannot be recycled or have no economic value anymore.

b. Based on the source of the pollutant

Waste comes from various activities, such as activities at home, in factories, or in the office. Therefore, waste is classified into two based on the source of pollution, namely domestic sources and non-domestic sources.

1. Domestic sources: All waste from pharmacies, hospitals, rural areas, cities, markets, roads, terminals, houses, kitchens, laundry facilities, bathrooms, and so on, is a class of domestic waste.
2. Non-Domestic sources: Waste from factories, agriculture, fisheries, transportation, livestock, and so on, is a group of non-domestic waste.

c. Based on its chemical properties

Based on its chemical properties, waste can be divided into two, namely organic waste and inorganic waste.

1. Organic Waste: Organic waste can decompose or be degraded by microorganisms, so it must be wisely disposed of organic waste into the environment. If organic waste can decompose due to microorganisms, then organic waste can increase the population of microorganisms. It is very likely that this organic waste can cause pathogenic bacteria that endanger human life, especially if this organic waste is discharged into the waters.
2. Inorganic Waste: Inorganic waste, different from organic waste, is non-perishable and difficult to degrade. Usually this waste has elements such as Lead (Pb), Arsenic (As), Cadmium (Cd), Mercury (Hg), Chromium (Cr), Nickel (Ni), Calcium (Ca), Magnesium (Mg), Cobalt (Co), and so on. When inorganic waste is discharged into the environment, there is usually an increase in the amount of metal ions.

3.3. Analysis of Student Knowledge Regarding B3 Waste

To find out the awareness of UNS students about B3 waste, we distributed questionnaires regarding B3 waste, starting from what is meant by B3 waste, what are the impacts of B3 waste, how to handle it to dispose of B3 waste and many others. Distribution is carried out through social media, such as Whatsapp, both in personal messages and on the Whatsapp Story feature with the target respondents being UNS students from all faculties and generations. Based on the questionnaires that have been distributed, there were 48 respondents who filled out the form completely.

A questionnaire that we addressed to respondents. These questions are the result of our summary to gain knowledge and awareness of UNS students regarding B3 Waste. There are 2 types of questions, namely questions that are only answered with yes or no, then questions that are answered by choosing from two options. For the first question that answered "yes" there were 38 people and

those who answered "no" were 10 people. then for the second question there were 45 people who answered "Hazardous waste that can disfigure, damage and endanger which can come from various sectors" and who answered "Hazardous waste which can disfigure, damage and endanger and comes from hospitals" there are 3 people. Then for question number 3, all respondents answered "yes". In question number 4, all respondents answered "Because it is corrosive, pollutes and endangers the surroundings." For question number 5 who answered "Yes" there were 27 people, 18 people answered "Don't know" and 3 people answered "No". For question number 6 who answered "Yes" there were 26 people and those who answered "No" were 22 people. For question number 7 who answered "Yes" there were 16 people and those who answered "No" were 32 people. For question number 8 who answered "Important" there were 47 people and those who answered "Just so" were 1 person. For number 9 who answered "Yes" there were 41 people and those who answered "No" were 7 people. For question number 10 who answered "Directly thrown into the trash" there were 3 people, "Distributed to the processing plant" there were 41 people, and "Processing the resulting B3 waste yourself" were 4 people. Then for question number 11 who answered "All true" there were 35 people, who answered "Detergents, perfumes and mosquito coils" there were 5 people, and "Injections, chemicals and infusions" were 8 people. In question number 12 who answered "Yes" there were 41 people and those who answered "No" were 7 people. For question number 13 who answered "Not participating" there were 7 people, who answered "Participating and donating energy" were 34 people, and "Participating and donating money" were 7 people. For question number 14 who answered "2 times a month" there were 15 people, who answered "1 time a month" there were 29 people and "4 times a month" there were 5 people. And for the last question, question number 15 who answered "Providing guidance about B3 waste" there were 31 people, then 6 people answered "Providing funds to manage B3 waste" and for the answer "Never involved" there were 11 people.

In addition to distributing questionnaires, we also conducted interviews with several respondents from UNS in order to obtain reliable data. Interviews were conducted with 10 respondents from every faculty at UNS. All of the informants said that they knew what B3 waste was and all of them said that B3 waste is hazardous and toxic waste, but only 7 out of 10 respondents said that B3 waste can be generated from various sectors while the other 3 said that B3 waste is only generated from the health sector. All of the informants said that B3 waste has a negative impact on the environment and health if it is disposed of carelessly without processing it first. 7 out of 10 informants said they had seen B3 waste and had produced B3 waste, but for the question form 2 informants said solid, 1 informant said liquid, 3 informants said solid and liquid then 4 respondents said solid, liquid and gas. Furthermore, for the example of B3 waste, 10 informants had various answers, such as needles, injections, batteries, detergent, oil, insect repellent, batteries, vehicle batteries, room cleaners, hairspray, infusions and pesticides. 9 out of 10 informants said they can reduce, overcome, prevent and manage B3 waste, but only 3 out of 10 informants know how to manage B3 waste, especially what they produce, namely by not disposing of residual detergent water directly into water or soil sources, reusing batteries used and exchange used batteries. 4 out of 10 informants said that they had seen the B3 waste management process and there was only 1 informant who around his house had a B3 waste management institution. All of the informants agreed that it is very important to reduce, overcome, prevent and manage B3 waste this is because B3 waste is a hazardous and toxic substance that has the potential to damage the environment and health if not treated properly, then 9 out of 10 informants said it is important to have policies or regulations related to B3 waste management, but there is 1 informant who said it is more important if the existing regulations are strengthened and confirmed with a reliable supervisory agency so that there will be no mistakes in B3 waste management. Furthermore, 8 out of 10 informants said it was important to have a campaign or program related to B3 waste but there were only 6 informants who said they would participate in the campaign. 10 informants have different suggestions related to B3 waste management, namely, not excessively using products that will later become B3 waste, managing as well as possible so as not to pollute the environment so as to cause poisoning or death of living creatures, manage B3 waste far from settlements so as not to interfere with activities. humans and damage the surrounding ecosystem, provide education to local residents about efforts to reduce, overcome, prevent and manage B3 waste so that ordinary people understand better and invite the government to activate the B3 waste management movement in villages, sub-districts or districts. Based on the results of the questionnaires and interviews that we have conducted, it can be concluded that students' awareness of B3 Waste is good, there are at least 38 respondents who already know and understand about B3 Waste by answering the first question with the "Ya" option, then 45 respondents have also answered that B3 Waste is waste that can damage, pollute, and endanger the environment (Pontoh, 2020) from various sectors, including the health sector or B3 waste originating from goods or leftovers from medical activities that are no longer used and are infectious in nature such as used masks, used gloves, used bandages, used PPE, and others (Sitompul, 2021). Then, it can also be concluded that most students already understand how they process B3 waste, there are at least 41 respondents who answered to submit B3 waste to a waste management installation, because B3 waste that is not managed properly can have a bad impact on the environment and can spread through land, water, and air (Prasetyaningrum et al., 2017).

4. Conclusion

Based on the research that has been done, it is found that the understanding of students at Sebelas Maret University regarding B3 waste management is good. Sebelas Maret University students also know the meaning of B3 waste. B3 waste is business residue or residue from activities that contain toxic substances so that they can indirectly damage the environment, interfere with health and threaten human life and other living things in the area around the B3 waste disposal area.

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