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# The Level of Comprehension using Survey (Age 18-30 years old) about Domestic B3 Waste: Batteries

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**ABSTRACT**. The background of the research is caused by the widespread problem of domestic waste generation which is one of the biggest waste contributors in Indonesia, up to 38.3%. One type of domestic waste produced is the type of B3. Domestic B3 waste is only around 2%, but has a significant potential risk of danger, based on its characteristics of being flammable, highly reactive, explosive, corrosive, and high level of toxicity and persistence. Batteries are a type of B3 product that is often used in household appliances, especially in electronic devices. If the battery is disposed of without certain treatment, the heavy metals and toxic materials contained will have a serious impact on the environment. The research purposes, to determine the level of public understanding of domestic B3 waste 'Battery' related to attitudes, intensity of use, and management, with the research target of people aged 18-30 years. The research used an online questionnaire distribution method, obtained 58 respondents spread across the region, and majority of respondents came from Central Java (53%). The results showed that the majority of people used battery-powered electronic devices with the intensity of use quite often, 37.9% of respondents didn't know the dangers of battery B3 waste, 61.3% still didn't know how to treat battery waste properly-correctly and 66.7% don't know the regulations related to B3 waste. Also, 58.1% of respondents are normal regarding the importance of treating B3 waste. In conclusion, the public's understanding of domestic B3 waste batteries is still relatively low, so a more intense understanding effort is needed to build public awareness about the dangers of B3 waste disposal.

***Keywords:*** Battery, Domestic B3 waste, Comprehension survey

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## 1. Introduction

Waste material resulting from human activities is a serious problem for all countries in the world. The problem of waste in Indonesia itself is that waste continues to grow, landfills are getting narrower, garbage is a source of pollution and contamination of soil, air, and air, becomes a source and a place to live for germs that endanger health (Hasibuan, 2016) and lack of proper management. waste that is still insufficient (Rossiana et al., 2018). Based on data from the National Waste Management Information System, in 2020 Indonesia generated 33,171,983.20 tons of waste/year. Household waste is the largest source of waste with a proportion of 38.3%. From household waste that is generated, including B3 waste or Household Hazardous and Toxic Waste (SB3-RT). B3 waste is waste that contains hazardous materials that directly or indirectly interfere with the health of the environment and/or the lives of humans and other creatures. SB3-RT waste has characteristics, namely, flammable, explosive, corrosive, highly reactive, high level of toxicity and persistence (Lustiyati et al.,

2019; Astuti, 2010). Some examples of SB3-RT are lamps, cleaning fluids, aerosols, drug residues, paints, pesticide packaging, mercury thermometers, and batteries. B3 waste in domestic waste is 2% but even in very small amounts or concentrations, B3 waste still contains hazardous materials (Putra et al., 2019) so that SB3-RT has characteristics that can cause disturbances to human health and safety and the environment (Iswanto et al., 2019).,2016). As stated in PP No. 18 of 1999 in conjunction with PP No. 85 of 1999, B3 waste in small amounts can damage the environment, health, and damage living things (Muljani, 2021).

One of the B3 waste generated from households is battery waste. A battery is a can containing chemicals that can produce electrons (electrochemical reactions) (Muhlisin et al., 2015). The use of batteries as an energy source is very diverse, such as for remotes, toys, clocks, flashlights, and so on. The presence of various portable electronics currently triggers a high level of battery consumption plus access to batteries is also fairly easy (Sia et al., 2015). Chemically, batteries can be grouped into primary batteries and secondary batteries (Kuchhal & Sharma, 2019; Rarotra et al., 2020). Primary batteries are single-use batteries, tend to be inexpensive but have high life cycle costs, and are non-rechargeable or non-rechargeable (Kuchhal & Sharma, 2019; Rarotra et al., 2020). While the secondary battery is a battery that can be repeated after the power runs out by being recharged or rechargeable and in terms of price it is relatively more expensive than primary battery but the cost of its life cycle is cheaper. Most of the batteries used by households are portable batteries, both primary batteries, especially alkaline,

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zinc-carbon (Zn-C) and lithium (Li), as well as secondary batteries, especially nickel metal hydride. (NiMH), nickel cadmium (NiCd) and lithium-ion (Li-ion) (Ebin et al., 2019). In several studies it was found that in the generation of household battery waste, alkaline and Zn-C battery types mostly dominate the collected battery waste stream in terms of percentage by weight and amount (Ebin et al., 2019). Alkaline batteries made of carbon zinc do not cause much impact on the environment but their disposal in household waste creates a wrong practice and affects the collection of other household batteries that contain harmful heavy metals such as zinc, manganese, nickel, lithium, aluminum, copper , and silver (Gupta et al., 2017).

If the battery is just thrown away and ends up in the final dump (TPS/TPA), the heavy metals contained in the battery will have a negative impact on the environment. Toxic heavy metals in these batteries can pollute the environment by seeping into the soil and water so that they can contaminate water bodies and make water unfit for use by humans and animals (Kuchhal & Sharma, 2019). The seepage of heavy metals into the soil will also be absorbed by plants (Sia et al., 2015) so it is likely that these heavy metals will enter the food chain (Ulimaz et al., 2021) and will interfere with human health. Such as exposure to cadmium compounds produce various kinds of negative effects on human health. The accumulation of cadmium in the kidneys can cause kidney disease and increase the risk of lung cancer (Rarotra et al., 2020). In addition, excess cadmium in the body will also cause high blood pressure, kidney damage, loss of red blood cells, and gastric disorders (Sia et al., 2015) and many other negative effects resulting from heavy metal pollution on the environment and food. Meanwhile, if battery waste is burned, certain toxic metals may be released into the air through flue gases or may accumulate in the ash produced by the combustion process (Rarotra et al., 2020).

Based on the description above, this research was conducted to determine the level of public understanding of B3 waste and the management of B3 waste generated from households, especially battery waste. The research carried out will include identifying the level of public knowledge about B3 waste, the intensity of battery use, and community attitudes towards battery waste.

## 2. Materials and Methods

### *2.1 Research Time*

This research was conducted for 19 days starting from November 1, 2021 to November 19, 2021. The stages carried out include the preparation stage, the implementation stage, and the data compilation stage. The preparatory stage is carried out on November 1, 2021 to November 3, 2021, by determining the theme and title of the research, as well as collecting questions to be asked to respondents regarding public understanding of B3 battery waste. The implementation stage is carried out on November 6, 2021 until November 13, 2021, by conducting a survey to respondents regarding public understanding of B3 waste from batteries. The data compilation stage is carried out on November 14, 2021 to November 19, 2021, by compiling the data that has been obtained from the results of the previous survey.

### *2.2 Research Location*

The location of this research was carried out in several areas according to the area where the respondents lived, because this research was conducted online by distributing questionnaires to several respondents. Obtaining research locations based on the results of the questionnaire, includes Central Java with a percentage of 53%, West Java with a percentage of 19%, DKI Jakarta with a percentage of 16%, East Java with a percentage of 3%, Banten with a percentage of 3%, DIY with a percentage of 2%, South Sumatera with a percentage of 2%, and Maluku with a percentage of 2%. From these results, it was found that the majority of respondents resided in the province of Central Java.

### *2.3 Data Collection and Analysis*

The data analysis method used in this research is a descriptive analysis method using a qualitative approach. The method of data analysis using a qualitative approach is a method of processing data in depth using the results of data from observations, interviews, and literature. In this study, data collection was carried out by collecting primary and secondary data. Primary data was collected by using surveys/questionnaires, while secondary data was collected by literature study. The survey/questionnaire method was carried out by distributing questionnaires to respondents with the acquisition of 58 respondents. The respondent criteria needed are respondents with an age range of 18 years to 30 years. Determination of criteria based on this age range is considered quite ideal because it can represent the level of public understanding of B3 battery waste. This questionnaire contains questions regarding the public's understanding of B3 battery waste to obtain research data results. This questionnaire was created using Google Forms and distributed through online media, such as WhatsApp. While the literature study was carried out by looking for journals or scientific articles related to B3 waste batteries.

## 3. Result and Discussion

### *3.1 Battery Characteristics*

Batteries are a source of electrical energy that is very often used in electronic equipment because it has advantages such as being easy to carry and practical (Nasution, 2021). The development of battery technology continues. There are several types of batteries that can be found in everyday life, namely primary batteries and secondary batteries. Based on these types, both have the same properties, namely converting chemical energy into electrical energy. The secondary battery is a rechargeable battery like a cell phone battery while the primary battery is a battery that can only be used once. Due to the high economic value of primary batteries, these types of batteries are found in large and small stores. There are many types of secondary batteries such as cell phone batteries, laptop batteries, coin batteries, and many more. Almost all portable electronics, such as cell phones, laptops, flashlights, and remote controls, use a secondary battery as a power source. With the secondary battery in the electronic device, there is no need to connect the power cord to activate the electronic device which makes it easy to carry anywhere (Sia et al., 2015).

The primary battery consists of three important components: carbon rods as anode (positive electrode of the battery), zinc (Zn) as cathode (negative electrode of battery), and paste as electrolyte (conductor). The main components of

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the battery contain chemical elements that can damage the environment and pollute, and are included in the category of B3 waste (hazardous and toxic materials) (Nasution, 2021). Used batteries are batteries that are no longer used. Batteries contain various chemicals such as mercury, manganese, lead, nickel, lithium, and cadmium. Mercury, lead, nickel, lithium, and cadmium are common in secondary batteries, while manganese is common in primary batteries. Therefore, battery waste includes B3 waste. Based on Government "Peraturan Pemerintah Republik Indonesia Nomor 101 Tahun 2014" concerning management of hazardous and toxic waste, hazardous and toxic materials, hereinafter abbreviated as B3, are substances, energy, and/or other components which due to their nature, concentration, and/or amount, either directly or indirectly, can pollute and/or damage the environment, and/or endanger the environment, health, and survival of humans and other living creatures. Hazardous and toxic waste, hereinafter referred to as B3 Waste, is the residue of a business and/or activity containing B3. B3 waste has the characteristics of being explosive, flammable, reactive, toxic, infectious, and corrosive.

Battery waste is included in the type of B3 waste because it has the potential to cause environmental pollution and cause adverse health impacts (Syahadah, 2019). Until now, battery B3 waste which is generally used by the wider community is still treated like domestic waste without special treatment from the government or the public (Iswanto et al, 2016). The chemical compounds contained in the battery include As, Cd, Co, Cr, Cu, Hg, Mn, Ni, Pb, Sb, Zn, and especially batteries containing sulfuric acid. According to the USA-EP (United States Agency for Environment Protec), one mercury battery in six tons of waste exceeds the mercury threshold allowed in solid waste, and one gallon of used oil is enough to pollute one million gallons of water and form 3,7 hectares of oil filters (Putra et al, 2019).

*3.2 B3 Waste Management and Impact*

The characteristics of B3 waste are reactive, toxic, corrosive, flammable, etc. (Iswanto et al, 2016). Hazardous waste generated must be managed properly. If B3 waste is not managed properly, it will have a negative impact on the environment and health (Putra et al, 2019). The impact of B3 waste on the environment can lead to degradation of the quality of water, air, soil, and living things in the vicinity. B3 waste contains toxic substances that can poison the food chain in ecosystems such as humans, animals and plants. Meanwhile, the impact on health results in various kinds of diseases, especially non-infectious diseases. Various diseases that can be caused by B3 waste are cancer, damage to organ functions, defects in the fetus, growth disorders both physically and psychologically, hypertension, intelligence disorders, damage to skin tissue such as irritation, and so on. Therefore, B3 waste such as batteries need special handling so as not to endanger the environment and health.In general, B3 waste can be managed using several techniques, namely thermal. landfills, and solidification. Thermal is thermal processing carried out at high temperatures. Meanwhile, based on PP No. 101 of 2014 what is meant by landfilling is the activity of placing B3 waste in a landfill with the intention of not endangering human health and the environment (Kurniawan, 2019). Furthermore, solidification is a stage of the B3 waste processing process to reduce the potential for toxins and the content of B3 waste through efforts to minimize/limit the solubility, movement/spread and toxicity (immobilization of toxic elements) before the B3 waste is disposed of to a landfill based on KEP 03/BAPEDAL/09/1995. In addition, there are several stages in the management of B3 waste, namely identification, storage, sorting, storage at B3

TPS, transportation and processing by third parties. Meanwhile, the role of the community itself can also be carried out in handling battery B3 waste.The first thing that can be done is socializing to the public about the dangers of battery waste for the environment and health. Second, sorting battery waste by throwing it in a special plastic that is different from other waste so that it doesn't get mixed up. Third, collect the battery waste in a certain place, for example in an RT there is a special B3 waste disposal site that the community collects into one.

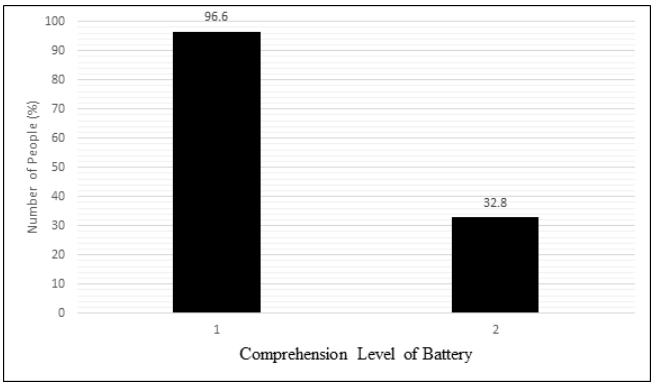


**Fig. 1** Comprehension Level of Battery

*Question List Description:*
*(1) Do you have battery powered electronics at home?*
*(2) Do you know what ingredients are in the battery?*

From the results of research that has been conducted a questionnaire asked several questions to several respondents with an age range of 18 to 30 years from different cities of origin in almost all areas of Java with the largest number coming from Kebumen, Central Java. Some of the answers from respondents stated that on average they have various battery-powered electronic devices in their homes. It is undeniable that almost all electronic equipment used today uses electrical energy, especially batteries that can convert chemical energy into electrical energy that can conduct electricity so as to make electronic equipment that uses these batteries lights up. It has become commonplace in society to use batteries in the electronic devices they use.

Then, some respondents answered in the next section about how often they change the batteries in electronic equipment. From the data obtained, the intensity of respondents in replacing batteries reaches 1 to 5 times with the highest intensity being 3 times on the electronic devices they use. This must be done because the battery has a limited amount of power that can be delivered. When the battery is still full, the electronic equipment used will run optimally. Meanwhile, if the battery power has weakened, the electronic devices that use the battery will also weaken. So when the battery is weak, it needs to be replaced with a new battery so that the electronic device can be used again. The battery whose power has been weakened is of course no longer in use and the battery will definitely be discarded.

The battery is of course composed of various kinds of chemicals that are in the battery. The chemicals in the battery have a dangerous content if thrown away. People usually

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underestimate that discarded batteries will be safe for the environment, which is actually not the case. From the results of the answers the respondents answered that most of them as much as 37.9% did not know what chemicals were contained in the battery. There are some who understand all of it and some who only understand part of it. This can be a reflection that it is true that most people do not understand the content of chemicals in batteries, so people tend to throw away batteries like garbage in general. Then, from the answers of the respondents who understood and only partially understood the content of the chemicals in the battery, they could mention it well. Some of the respondents' answers stated that the chemical ingredients in the battery are carbon, lithium, manganese, aluminum, zinc, cadmium, alkaline, and so on. In addition, there were also respondents who answered that they did not know what chemicals were contained in the battery. Some of the chemicals as mentioned by the respondents are hazardous chemicals if thrown away into the environment.

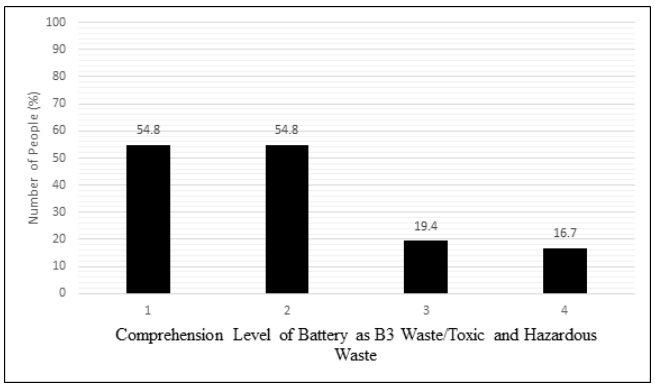


**Fig. 2** Comprehension Level of Battery as B3 Waste/Toxic and Hazardous Waste

*Question List Description:*
*(1) Do you know what "B3 Waste" is?*
*(2) Are you aware of the dangers that can arise if batteries are disposed of carelessly?*
*(3) Do you know how to properly and correctly manage B3 Waste (especially batteries)?*
*(4) Are you aware of Waste Battery handling and regulation?*

There are several reasons why the chemicals contained in the battery become dangerous, one of which is because the chemicals contained in the battery, if disposed of, will enter the category of B3 waste. B3 waste needs to be handled in a special way so that it cannot be handled carelessly. Of the several respondents who answered what B3 waste was, most of them already knew with a percentage of 54.8%. Even so, there are also those who do not understand what B3 waste is with a percentage of 45.2%. The data can still be said to be good, although almost half of the respondents' answers stated that they did not know what B3 waste was.

However, based on the previous data, it is necessary to ask again about how to properly treat B3 waste. From the answers of the respondents, there were those who answered that B3 waste could be treated by recycling, not throwing it away, managing it by thermal means, and so on. In addition, some of the answers they answered did not know how to treat B3 waste properly. From the results of the respondents' answers, they are good, but respondents who answer that they do not know how to treat B3 waste properly need to be given a basic understanding in advance of what dangers arise if B3 waste is simply dumped into the environment. So from the impact of B3 waste, they will begin to realize and change their mindset for the better regarding how to treat B3 waste properly.

As previously explained, batteries are included in the category of B3 waste. So if batteries that are no longer used are thrown away into the environment, it will certainly have a serious impact on the environment and the health of the surrounding community. B3 waste that is simply thrown into the environment will cause environmental degradation such as disruption of the ecosystem order. Meanwhile, the impact on the health of the surrounding community can experience cancer, organ dysfunction, and the risk of other dangerous diseases for the body. From the answers the respondents answered that many of them knew about the dangers of batteries being thrown away by 54.8% and some of them also answered that they did not know and maybe 22.6% each. This can still be said to be very good, because more than half of the respondents already know the dangers of batteries being thrown into the environment.

In the management of B3 waste, especially battery waste management, it is still relatively low because only 19.4% of people know how to manage B3 waste, especially batteries that are good and correct, 61.3% do not know how to take the right steps for proper management, and 19, 4% are still unsure about their answer. From the results of respondents' answers regarding the understanding of battery waste management, it is still relatively low and socialization is still needed to increase awareness of the proper disposal of battery waste.

The handling and regulations that apply are also still minimally known to the public, from the results of the respondents there are only 16.7% who know the regulations regarding B3 waste, 16.7% know at a glance, and 66.7% do not know about the regulation and handling of B3 waste batteries. apply. From this it can be concluded that there is a lack of education and information conveyed to the wider community in the management of battery B3 waste.

**Table 1**
Concern of Dispose Waste Battery

| Concern of Dispose Waste Baterry | % |
|---|---|
| Very Interested | 6,5 |
| Interest | 29 |
| Indifferent | 58,1 |
| Uninterested | 6,5 |
| Very Uninterested | 0 |
| **Total** | 100 |

From some of the data that has been explained about their understanding of the battery, of course, it needs to be paid attention to by various parties. Judging from the answers of the respondents who answered questions about their attitude in disposing of batteries, as many as 58.1% answered normal, 29% answered carelessly, and the rest answered they didn't care and really care. These results are really concerning because many of them get when they dispose of the battery, they consider the battery as ordinary garbage and does not harm the environment. In fact, if they know what content is in the battery, of course they will do the best way to dispose of the battery. Even so, there are also those who still care about quite a lot so it is still quite good because some of them have understood how to dispose of the battery properly.

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**Table 2**
Dispose Waste Battery without Management

| Dispose Waste Baterry without Management | % |
|---|---|
| Very Often | 25,8 |
| Often | 29 |
| Occasionally | 19,4 |
| Not Often | 16,1 |
| Never | 9,7 |
| **Total** | 100 |

The frequency of disposing of used batteries without special management was found to be very often 25.8%, often 29%, sometimes 19.4%, not often 16.1%, and never 9.7%. From these results, awareness of the disposal of used batteries is still minimal. This is related to understanding the proper management of battery waste.

## 4. Conclusion

From this survey, we can conclude that the understanding of people aged 18-30 years regarding the management of domestic B3 waste in the form of batteries is still lacking. In addition, there is less interest in knowing the processing of battery waste. This results in the disposal of the battery without prior treatment is still lively.

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