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Analysis of Public Awareness in Toxic and Hazardous Waste Management in Tingkir District, Salatiga City

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ABSTRACT. Toxic and Hazardous Waste Materials are the residues of businesses or activities, both from the industrial, tourism, health services, and household sectors that contain Toxic and Hazardous Waste. Toxic and Hazardous Waste is explosive, flammable, reactive, toxic, infectious, and corrosive. Toxic and Hazardous Waste Materials that are disposed of for free without going through a strict filtration process can pose a danger to the environment and living creatures around it. The hierarchy of Toxic and Hazardous Waste management seeks to reduce sources, processing materials, the substitution of materials, regulation of activity operations, and the use of clean technology. Understanding Toxic and Hazardous Waste is very important to shape a person's attitude or behaviour towards the surrounding environment. This study aims to determine the level of understanding of the community in Tingkir District, Salatiga City, about Toxic and Hazardous Waste, Types of Toxic and Hazardous Waste, and how to manage the Toxic and Hazardous Waste. The method used in this study uses descriptive qualitative methods by distributing questionnaires addressed to the people of Tingkir District, Salatiga City, with a minimum age of 17 years as the primary data. In addition, secondary data is also used to support this research. Secondary data is obtained by collecting scientific journals or articles related to this research. The data is then analysed to reveal public awareness in Tingkir District in Toxic and Hazardous Waste management. The results showed that the community in Tingkir Subdistrict, Salatiga City, still lacked a thorough understanding of Toxic and Hazardous Waste and its management, especially domestic Toxic and Hazardous Waste generated every day. This is evidenced by the results of the questionnaire, which obtained 37 respondents, of which only 12 respondents understood about Toxic and Hazardous Waste and how to manage it.

Keywords: Knowledge, Awareness, Toxic and Hazardous Waste.

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1. Introduction

As the human population increases, the needs will also increase. This will also increase the waste produced, including Toxic and Hazardous Waste. Toxic and Hazardous Waste is the residue of businesses or activities, both from the industrial sector, tourism, health services, and domestic households, that contain Toxic and Hazardous Waste. Toxic and Hazardous Waste has the characteristics of being explosive, flammable, reactive, toxic, infectious, and corrosive. Of the total household waste, Toxic and Hazardous Waste only contributes about 2% (Intan and Rijati, 2019). Judging from these figures, household Toxic and Hazardous Waste is relatively small, so sometimes it doesn't get attention. This is proven by the fact that many people still do not separate Toxic and Hazardous Waste from other domestic waste (Mildayati et al., 2021). Although relatively few in number, However, with a high population, the amount of waste will also increase. So this cannot be used as an excuse to ignore the presence of Toxic and Hazardous Waste from households. Sources of household Toxic and Hazardous Waste can be divided into Toxic and Hazardous Waste from non-specific sources, Toxic and Hazardous Waste from specific sources, and Toxic and Hazardous Waste from expired chemicals, spills, used packaging, and product waste that does not meet specifications. Non-specific source Toxic and Hazardous Waste is Toxic and Hazardous Waste that does not come from the primary process but from equipment maintenance activities, washing, corrosion inhibitors, scale dissolving, packaging, and others. Then, Toxic and Hazardous Waste from specific sources is Toxic and Hazardous Waste originating from starting materials, products, or the rest of the processes of an industry or particular activity. Examples of Toxic and Hazardous Waste from households are used batteries, used neon, light bulbs, cosmetics, paint packaging, and much more. From these various examples, the most common types of Toxic and Hazardous Waste generated from households are electronic waste, used electric lamps, and used batteries (Sartika et al., 2020).

This Toxic and Hazardous Waste must be separated from other waste because it can harm the environment and humans. Therefore, special handling is required. Household Toxic and Hazardous Waste are explicitly managed according to the applicable regulations in the area (Wahdatunisa, 2019). In the management of Toxic and Hazardous Waste, attention must be paid to the management hierarchy. The hierarchy of Toxic and

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Hazardous Waste management seeks reduction in sources, processing materials, the substitution of materials, regulation of activity operations, and the use of clean technology (Sidik et al., 2018). Toxic and Hazardous Waste management can be carried out in several ways, namely, reduction, which includes restriction, recycling, reuse, and handling, which provides for activities of sorting, collecting, transporting, processing, and final processing. So, prioritized to minimize the use of products that can generate Toxic and Hazardous Waste. If Toxic and Hazardous Waste is managed correctly, it can reduce the negative impacts caused by the waste.

Toxic and Hazardous Waste Materials that are disposed of for free without going through a strict filtration process can pose a danger to the environment and living creatures around it. According to Pertiwi et al. (2017), Toxic and Hazardous Waste has different characteristics and properties from waste in general. This is because Toxic and Hazardous Waste has unstable properties (reactive, explosive, flammable, and toxic). Toxic and Hazardous Waste also has a very dangerous impact if it is disposed of carelessly in the environment. In general, the effect of Toxic and Hazardous Waste on humans has two categories, namely acute effects and chronic products. Acute effects cause damage to the nervous system, digestive, cardiovascular, and respiratory systems, as well as skin diseases and even death. Meanwhile, chronic effects cause cancer-triggering effects, mutations in body cells, congenital defects, and damage to the reproductive system. Toxic and Hazardous Waste can also damage or interfere with the respiratory and digestive systems. Lung tissue will be severely damaged, and food contaminated with waste causes liver damage. Therefore, there is a very significant division between the management of ordinary races and Toxic and Hazardous Waste. The manufacture of symbols and labels on Toxic and Hazardous Waste refers to government regulation no. 14 of 2013, which contains symbols and labels for Hazardous and Toxic Materials waste, this labelling on Toxic and Hazardous Waste includes Toxic and Hazardous Waste identity labels, labels for empty labelling packaging, and packaging cover instructions labels (Murti, and Ayu 2018). The Toxic and Hazardous Waste symbol is a characteristic that the waste has, usually in the form of writing. Toxic and Hazardous Waste itself has ten symbols including, the hazardous waste symbol, which is intended for waste that has the nature of polluting the environment and is not easily decomposed by natural processes. Finally, the mixed waste symbol is intended for waste that has hazardous compounds in it. With the existence of symbols and labels regarding the dangers of Toxic and Hazardous Waste, it is hoped that the community or workers will understand the characteristics of Toxic and Hazardous Waste in the surrounding environment.

Public awareness of the cleanliness of the surrounding environment is very important to maintain. However, in the studies that have been carried out, public awareness of environmental cleanliness, such as river participation, is very low. This is caused by the habit of people who litter in the river and consider it a normal thing (Wijaya and Muchtar, 2019). In addition to rivers, public awareness of the environment needs to be maintained about land and forests where fires can occur. This is not only caused by nature, such as summer but also caused by humans, such as burning for land clearing (Kamarullah et al., 2019). Even on a household scale, Public awareness to care for the environment must be increased because household waste is one of the contributors to the most significant volume of waste going to the final management site (Bahtiar et al., 2018). Therefore, there is a new paradigm for waste management: reducing, reusing, and recycling. This changes the old paradigm where waste is only collected, transported, and then disposed of at the final management site (Nurcahyo and Ernawati, 2019). To improve the new paradigm, it is better to establish a waste bank at several regional points. The waste bank can manage scattered waste problems, thus making waste more economically valuable (Ratnah et al., 2021). In addition to changing into a more economical object, the waste bank can also educate household waste management with the 3R concept as minimization of waste piles that are increasingly piling up at the final management site (Susanti and Arsawati, 2021). Not only for ordinary waste, but waste management from households also applies to Toxic and Hazardous Waste, such as used batteries, used lamps, expired drugs, and vehicle lubricants. This is done so as not to cause health problems to humans and the environment caused by Toxic and Hazardous Waste because this Toxic and Hazardous Waste can cause direct impacts such as fire or indirect impacts such as corrosive (Putra et al., 2019). Then a study entitled "Analysis of public awareness in the management of Toxic and Hazardous Waste in Tingkir District, Salatiga City" was conducted, which aims to identify the types and potentials for the number of household wastes that fall into the category of hazardous and toxic materials, in addition to knowing the understanding and management of Toxic and Hazardous Waste owned by society.

2. Materials and Methods

This research was conducted in November 2021. The research was conducted in Tinker District, Salatiga City, Central Java. Salatiga City, with an area of 56.78 km^2, consists of 4 sub-districts and 23 urban villages. Tingkir sub-district consists of seven villages, namely Gedongan, Kalibening, Kutowinangun Kidul, Kutowinangun Lor, Sidorejo Kidul, Tingkir Lor, and Tingkir Tengah. Geographically, Salatiga City is located between 110° 28' 37.79" and 110° 32' 39.79" east longitude. Salatiga City has an average height of 571 m above sea level.

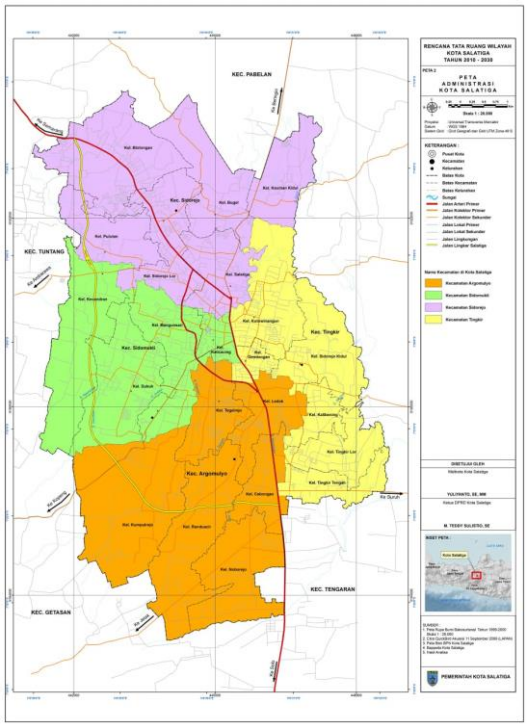

Fig.1 Salatiga City Administration Map

2.1 Data Retrieval

1. Primary Data

The primary data in this study came from the results of the distribution of questionnaires or questionnaires, and some came from the results of interviews with people aged around 17-56 years with a dominant age of 17-30 years. The target speakers are specific to a particular area, Tingkir District community. Data were obtained in the form of public knowledge regarding Toxic and Hazardous Waste, management efforts that have been carried out by the community to manage and reduce Toxic and Hazardous Waste, and the level of public awareness regarding Toxic and Hazardous Waste management.

2. Secondary Data

For secondary data, it is taken from various data or information that already exists and is used to complement the primary data. The secondary data in this study were obtained from studies or literature studies on Toxic and hazardous waste that are available online.

2.2 Data Analysis

This research requires tools in the form of tally sheets and google forms. The first step is to determine the research theme, namely Toxic and Hazardous Waste. Then the research location was chosen, namely Tingkir District, Salatiga City, Central Java. The research was conducted using a qualitative method with a descriptive approach. This qualitative method was obtained by distributing questionnaires addressed to the people of Tingkir District Salatiga City, with a minimum age of 17 years. From the questionnaire, data were obtained in the form of public knowledge regarding Toxic and Hazardous Waste, management efforts that have been carried out by the community to manage and reduce Toxic and Hazardous Waste, and the level of public awareness regarding Toxic and Hazardous Waste management. In addition to the primary data, secondary data is also used to support this research. Secondary information is obtained by collecting scientific journals or articles related to this research. The data is then analyzed to reveal public awareness in Tingkir District in Toxic and Hazardous Waste management.

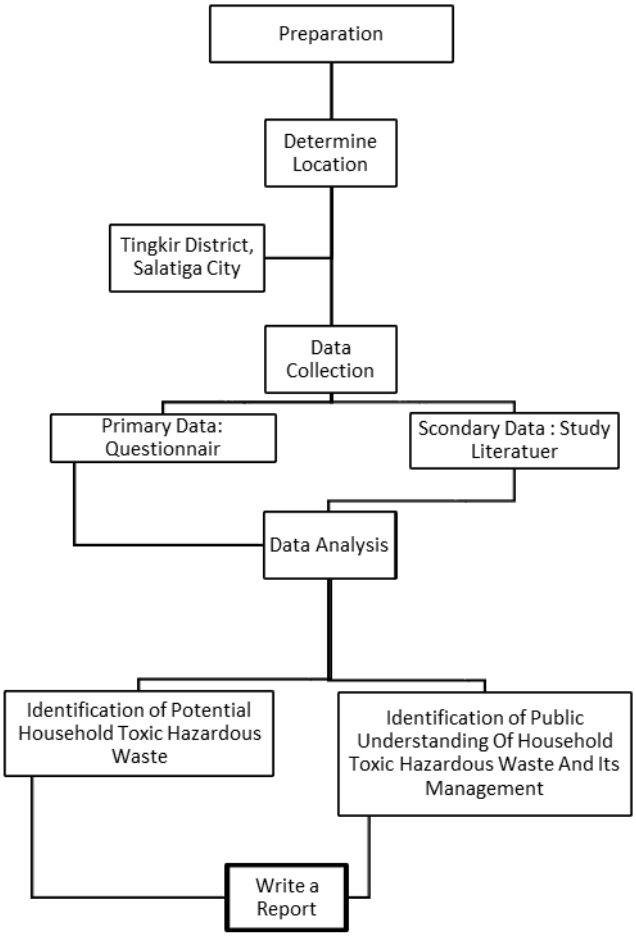

Fig.2 Flowchart

3. Results and Discussion

Table 1
Respondent Data

Criteria	Information	Amount
Age	17-30 years	19
	31-50 years old	14
	51-56 years	4

3.1 General Knowledge of Hazardous Waste

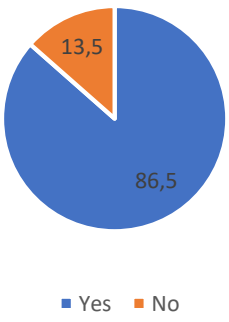

Fig.3 Knowledge Relate to Toxic and Hazardous Waste

According to Government Regulation No. 101 of 2014 concerning the management of hazardous and toxic waste, Toxic and Hazardous Waste is a substance, energy, or another component which due to its nature, concentration and quantity, either directly or indirectly can pollute or damage the environment, health, and human survival and other living things. Over time, population growth will continue to increase and correlate with the needs of every human life, which will increase as well, which will cause an increase in the volume of waste. Of course, this is a concern for every community, not to mention the piles of Toxic and Hazardous Waste that are thrown away without special management, and there are still many people who underestimate Toxic and Hazardous Waste or waste. Therefore, there is a need for special socialization for each community.

Table 2
Knowledge Relate to Toxic and Hazardous Waste

Parameter	Results (%)
Really don't understand	2.7
Do not understand	18.9
Neutral	37.8
Understand	18.9
Very understand	21.6

In Figure 3 it can be concluded that 86.5% of the people of the Tingkir sub-district of Salatiga City already know what Toxic and Hazardous Waste are, and 13.5% still do not know what Toxic and Hazardous Waste are. However, it is unfortunate that the understanding of Toxic and Hazardous Waste in the Tingkir sub-district of Saltiga City is still relatively low based on Table 2. 37.8% of respondents answered neutrally, which means that people are still confused about the further understanding of Toxic and Hazardous Waste, such as the nature, impact, danger, etc. then as many as 21.6% answered very understand. While the remaining 18.9% answered understood and did not understand, and as much as 2.7% responded that they did not understand. There are several factors that cause the people of Tingkir City to be still confused about the understanding of Toxic and Hazardous Waste, namely the lack of information and knowledge about Toxic and Hazardous Waste. Lack of field practice regarding what Toxic and Hazardous Waste are. The problem is that there are facilities and infrastructure to understand Toxic and Hazardous Waste. Understanding related to Toxic and Hazardous Waste is very important to know the problems and further impacts produced by Toxic and Hazardous Waste so that the community can apply related to Toxic and Hazardous Waste management.

Types of hazardous and hazardous materials are regulated in Government Regulation No. 74 of 2001 concerning the management of hazardous and toxic materials. Toxic and Hazardous Waste is divided into two categories, namely Toxic and Hazardous Waste category 1 is waste that has a direct impact on humans and the environment, and category 2 is waste that has an indirect impact on humans and the environment. Still, this category 2 has a long-term or chronic impact. In addition, Toxic and Hazardous Waste can be grouped based on its sources, such as specific, non-specific sources and the extent of race or spillage or used B3 packaging. Specific waste sources are further divided into two types: Toxic and Hazardous Waste, from general specifics such as activated carbon waste, used chromic acid, tanning process waste, and special specific waste such as copper slag and nickel slag, and EAF dust. Then the non-specific sources of waste are sources that come from washing tools or preventing corrosion, packaging, and dissolving crusts such as used batteries, used packaging, resin waste, electronic waste, used lubricating oil. Then on the last source, namely the source of expired/spilled/packaged Toxic and Hazardous Waste, methanol, metapyrylene, malononitrile, and lead subacetate waste. Toxic and Hazardous Waste can also be distinguished based on its type, namely infectious waste originating from hospitals or medical and non-infectious waste, non-medical waste. From the analysis results, the people of the Tinggir sub-district generally already know the types of waste based on the source and type. Still, the community is more aware of non-infectious Toxic and Hazardous Waste, which is comprehensively included in all sources of Toxic and Hazardous Waste generated such as batteries, glass bottles, electronic used goods, used oil containers, used lamps, used electric cables, copper, detergent soap waste, textile dye waste, factory waste, insect repellent, styrofoam, garbage, glue, hair spray, pesticides, chlorine, oven cleaner, paint, ink, ACU, hand spoon, water kaskus, and used oil. This non-infectious waste is a category two waste, namely, waste that indirectly impacts humans and the environment. However, some people already understand infectious waste, namely the waste of used needles, laboratory materials, infusion hoses, pieces of used cloth or gauze, masks, and hazmat. This infectious waste is waste that requires special transportation in the transportation of these goods. In addition, infectious waste includes category one waste, namely waste that directly impacts humans and the environment.

3.2 Hazardous Waste

Table 3
Management of Toxic and Hazardous Waste

Parameter	Results (%)
Absolutely unnecessary	2.7
Not required	2.7
Neutral	8.1
Required	24.3
Is indispensable	62.2

Furthermore, to determine the community's understanding of the dangers of Toxic and Hazardous Waste for the environment and health, the public's opinion was first asked whether special handling is needed in managing Toxic and Hazardous Waste. From here, it is hoped that the community will understand the need for special handling of Toxic and Hazardous Waste based on an understanding of the definitions and types that have been known previously. Based on Table 3, it was found that 62.2% of 37 respondents answered that it was very necessary. Then as many as 24.3% of the respondents also answered that a special Toxic and Hazardous Waste management was needed. Meanwhile, only 2.7% thought that special handling of Toxic and Hazardous Waste was not required, and 2.7% considered it very unnecessary. However, from this, it was found that almost all respondents agreed on Toxic and Hazardous Waste management specifically.

This is in line with Toxic and Hazardous Waste characteristics, such as toxic, explosive, infectious, corrosive, and reactive, which can potentially endanger humans and the environment, so that special handling is needed (Kurniawan, 2019). The high number of people who have understood the need for Toxic and Hazardous Waste management is the first step for real action in the future. This is because a proper understanding will be the basis for behaviour in their daily lives. Awareness of the attitude of waste management,

especially Toxic and Hazardous Waste, helps someone understand the need for action. There are four levels informing action: perception, guided response, mechanism, and adoption (Widawati and Hasnita, 2019). Then awareness will form a perception that is of the importance of special handling in Toxic and Hazardous Waste management.

Table 4
The dangers of Toxic and Hazardous Waste posed to the environment

Parameter	Results (%)
Very harmless	2
Not harmful	0
Neutral	1
Dangerous	35.1
Very dangerous	56.8

Then the community's opinion was also asked regarding the level of danger caused by Toxic and Hazardous Waste for the environment. Based on Table 4. It was found that 35.1% of respondents answered dangerously, and 56.8% of respondents also answered very dangerously. In comparison, the remaining 1% answered neutral or could be dangerous and also not destructive and as much as 2% considered Toxic and Hazardous Waste to be very harmless. The dangers of Toxic and Hazardous Waste posed to the environment include various components such as abiotic and biotic components. In the abiotic component, respondents understand that Toxic and Hazardous Waste will impact soil and water pollution and decrease the quality of both. Toxic and Hazardous Waste from used detergent bottles or even liquid used for washing using detergent can be harmful to the environment. This is because pollution is caused by hazardous chemicals that react with water and soil (Nursabrina et al., 2021).

Furthermore, soil pollution caused by toxic substances from Toxic and Hazardous Waste is then absorbed so that it has the potential to reduce plant productivity and disease transmission media. This impact will be felt if Toxic and Hazardous Waste accumulates for a long time, which will be supposed years later (Hilda et al., 2021). There is also the potential for ecosystem fires from CFC waste generated by cooling machines and other disasters. The component that will have the following impact when soil and water pollution occurs is the impact on living things. Decreasing soil quality due to contamination will have an impact on plant death. Plus, the number of incidents of animals eating or being entangled in the garbage is one of the impacts. Human life also has potential, especially for waste or waste processing workers who can be injured due to hazardous waste. Potential acute impacts such as nerve damage, digestion, damage to the skin, and the impact of crisis such as carcinogenic and mutagenic effects on humans are also the dangers of Toxic and Hazardous Waste (Putra et al., 2019).

Table 5
The dangers of Toxic and Hazardous Waste posed to the health

Parameter	Results (%)
Very harmless	2.7
Not harmful	0
Neutral	5.4
Dangerous	18.9
Very dangerous	73

Then asked also the opinion of the public regarding the level of danger that will be caused by Toxic and Hazardous waste for health, especially humans. Based on Table 5. 18.9% of respondents answered dangerously, and 73% of respondents also answered very dangerously. While the remaining 5.4% answered neutral or can be made and harmless, and as many as 2.7% rated Toxic and Hazardous waste very harmless. Understanding the impact of Toxic and Hazardous waste on health is also assessed from the description of the impacts mentioned by respondents, such as respiratory system disruption, poisoning, digestive problems, problems in the skin, both injured, and the presence of harmful substances. This is due to the corrosive, toxic, infectious, explosive, and other toxic and hazardous waste properties to cause the impact. Toxic and Hazardous waste such as aerosol cans, if not managed correctly or in the sense of being disposed of directly, will be dangerous to the surroundings because of the possibility of exploding when exposed to heat. Similarly, light bulb waste that can injure waste transport workers and the surrounding community. So efforts are needed to reduce the impact, one of which is wrapping and inserting waste that can harm the surroundings into dropbox, which would be better if thrown at the authorities (Muljani, 2021). So that the safety of garbage transport workers will be safer even though efforts are also needed to reduce Toxic and hazardous waste. So it was found that the community, in addition to understanding the impact caused by Toxic and Hazardous waste, also knew what the impact was even though broadly speaking.

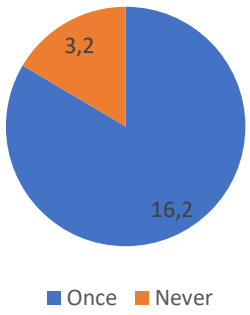

Fig.4 Socialization or seminars related to Toxic and Hazardous Waste

Public understanding of Toxic and Hazardous Waste and its dangers can be factored in various things, one of which is the existence of socialization and education from experts regarding this matter. Environmental understanding with environmental care behaviour is considered a positive relationship (Sujana et al., 2018). Based on Figure 4, it was found that 83.8% of the total respondents had attended socialization or seminars related to Toxic and Hazardous Waste. Socialization and seminars can be a place for experts or activists who care about Toxic and Hazardous Waste problems to provide education to the public. Thus, in general, the people of Tingkir District have attended seminars or socialization at least once. This is correlated with community knowledge regarding Toxic and Hazardous Waste. However, more research is needed to conclude the extent of community implementation related to Toxic and Hazardous Waste management. In the future, it is hoped that the community will be able to implement community-based waste management as a new paradigm with an emphasis on community consumptive behaviour and awareness of the waste it produces for the environment.

3.3 Domestic Toxic and Hazardous Waste

Table 6
Type of Domestic Toxic and Hazardous Waste

Parameter	Results (%)
Don't Really Understand	2,7
Don't Understand	21,6
Neutral	43,2
Understand	16,2
Really Understand	16,2

From Table 6. the level of respondents' understanding of the sorting of Toxic and Hazardous Waste can be seen. Give points 1 to 5 starting from the level of not understanding very well to very understanding. The results obtained include 2.7% or one respondent chose point 1, which means they don't really understand, and as many as 21.6% or eight respondents chose point 2, which means they don't understand. The majority of respondents, as many as 43.2% or 16 respondents, chose point 3, which means neutral or just they doubt. Meanwhile, only 16.2% or six respondents decided to understand and very much, respectively. From the study results, it can be said that the level of understanding of Toxic and Hazardous Waste of residents in Tingkir District is still low. The number of people's misunderstandings about Toxic and Hazardous Waste makes residents still have the self-awareness to separate ordinary waste from Toxic and Hazardous Waste.

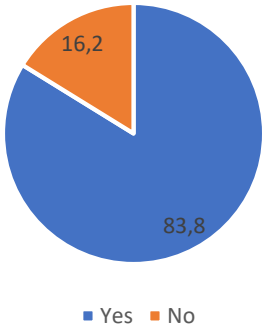

Fig.5 Produce household Toxic and Hazardous

From Figure 5. it is known that as many as 83.2% or 32 respondents produce household Toxic and Hazardous Waste, and 16.2% or five other respondents do not produce household Toxic and Hazardous Waste. Household wastes generated due to their anthropogenic activity include: Used Batteries, Used Light Bulbs, Aerosol Bottles, Detergents, and Used Cosmetics. It can be stated that the people in Tingkir Subdistrict use the materials referred to in the B3 group to fulfil their daily activities so that the people in the Tingkir District area have a high potential to become a contributor to Toxic and Hazardous Waste and its disposal is still arbitrary.

Table 7
Type of Domestic Toxic and Hazardous Waste

Type of Domestic Toxic and Hazardous Waste	Results (%)
Used Battery	70,3
Lamp	56,8
Aerosol	35,1
Used Plastic Bottles	45,9
Cosmetic Containers	45,9
Detergent	64,9

From Table 7. it can be seen how the respondent's understanding of household Toxic and Hazardous Waste samples is. Examples of household Toxic and Hazardous Waste are used batteries, light bulbs, plastic bottles, aerosol bottles, detergents, and cosmetics. There were 70.3% of respondents who chose used batteries, 56.8% of respondents who decided used light bulbs, 45.9% of respondents chose used aerosol bottles, 64.9% of respondents chose detergent, and 45.9% of respondents chose used cosmetic containers. From this, it can be seen that respondents still do not know what household Toxic and Hazardous Waste they produce.

3.4 Hazardous Waste Management

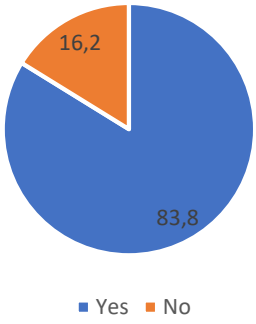

Fig.6 Regulations related to household Toxic and Hazardous Waste management

From Figure 6. It is known that as many as 83.8% of respondents said there were no regulations related to household Toxic and Hazardous Waste management in the area where they lived, while 16.2% said there were regulations. Several respondents gave examples of regulations related to Toxic and Hazardous Waste management in their area. These regulations, such as regulations for sorting household waste to be handed over to the management agency, regulations for sorting Toxic and Hazardous Waste and keeping it out of reach of children, as well as the prohibition of throwing hazardous waste into rivers. Example of Household Toxic and Hazardous Waste.

Fig.7 Lamp

Fig.8 Used Battery

Fig.9 Aerosol

Fig.10 Cosmetic Containers

Conclusion

Based on the test results, it was found that the types of household waste in Tingkir District, Salatiga City, were expired drugs, used batteries, broken glass, cans of air freshener, and bathroom cleaners so that these wastes have the potential as a category of hazardous and toxic materials. While the community's understanding of Toxic and Hazardous Waste Management, most people already understand it. However, what is highlighted is that the community has not received much socialization. Around the research location, most people say that there are no regulations related to Toxic and Hazardous Waste Management at the research location. The people there have trash bins at home, but only a few have separate bins. Most people do not understand the meaning and types of Toxic and Hazardous Waste.

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