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Identification of Hazardous and Toxic Waste in Workshops X Surakarta

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ABSTRACT. The increase in the number of motorized vehicle users causes the increasing human need for motorcycle maintenance and repair services such as workshops. However, this service actually creates new problems for the environment and the health of living things because it produces workshop waste which is classified as B3 waste (hazardous and toxic materials). The collection and management of workshop waste must be considered thoroughly starting from its place and how to manage it safely before being discharged into the environment. The purpose of this study was to identify the various types of B3 waste and to understand the management of B3 waste at Bengkel X. Bengkel X is one of the workshops in Surakarta City that receives repair and oil change services for motorcycles. The method used is a direct survey to the location of the workshop with data collection techniques using primary data. The results of this study indicate that there are 3 types of B3 waste, namely used oil waste, used oil bottle, battery waste, and cloth waste exposed to lubricants, for the amount of used oil waste in workshop X ranges from 25-30 L/month. The management carried out at X's workshop is storage in buckets which are then purchased by collectors or junkyards to be sold to factories.

Keywords: B3 Waste, Environment, Oil, Waste Management, Workshop.

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1. Introduction

Environmental problems are currently increasing and their impact has been felt in various aspects of human life both in Indonesia and in other countries. Many human activities have a negative impact on the quality of the environment, this is due to poor waste and waste management, as well as a lack of concern for the environment in the community. The increase in human population will have an impact on increasing the need for basic food and transportation needs. With the increasing number of motorized vehicles, this has an impact on increasing the volume of lubricating oil (Azteria and Gani, 2020). The increasing use of private vehicles and inappropriate vehicles as well as production processes in industries that produce high amounts of carbon are the causes of the decline in environmental quality. Along with the increase in the number of private vehicles, the increase in motor vehicle services such as repair shops is also increasing. According to Rubiono and Yasi (2017), automotive workshops such as car and motorcycle repair shops have the potential to produce hazardous and toxic waste (B3).

Vehicle workshop waste is included in the B3 waste class because it contains materials that are hazardous or toxic, can damage and pollute the environment and endanger human health either directly or indirectly (Akhmadi and Suharno, 2017). Several types of B3 waste generated from activities in the workshop are used oil, used batteries, and cloth that has

been contaminated by lubricants. Used batteries are B3 waste generated from workshops which are quite dangerous because they contain high levels of lead. Lead exposure can spread and expose the environment, especially workers and cause health problems so that in this case it is necessary to have special management of the waste produced (Hindratmo, B., et al. 2018). Some of the waste oil generated from the vehicle repair shop can still be used, however, this can also cause environmental damage if proper management and proper management are not carried out. Hazardous and toxic raw materials that are no longer used due to damage, packaging residue, process residues, spills, and used oil that require special management and handling can be grouped into the B3 waste group. B3 waste management can be carried out by parties who already have a permit from the Ministry of Environment and Forestry. B3 waste management must be carried out by business owners as an effort to protect the environment. and used oil that requires special management and handling can be grouped into the B3 waste group. B3 waste management can be carried out by parties who already have a permit from the Ministry of Environment and Forestry. B3 waste management must be carried out by business owners as an effort to protect the environment. and used oil that requires special management and handling can be grouped into the B3 waste group. B3 waste management can be carried out by parties who already have a permit from the Ministry of Environment and Forestry. B3 waste management must be

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carried out by business owners as an effort to protect the environment.

Every activity or business that has a relationship with B3 waste in terms of producing, collecting, transporting, utilizing, processing and storing must pay attention to environmental aspects. Activities in automotive workshops such as car and motorcycle repair shops involve a lot of materials classified as B3 waste, one of the materials produced is oil. The oil used in the maintenance, operation of the vehicle, will produce waste which is known as used oil. Used oil waste contains metals, chlorine solution, and other contaminants that can pollute the air, soil and water. In this case, there is a need for handling in the management of B3 waste in vehicle workshops. B3 waste management is an activity or technique carried out to avoid pollution and environmental damage as well as the health and safety of living things (Kristanti et al., 2021). Bengkel X is one of the workshops located in Surakarta City. In its activities in this workshop, several types of B3 waste can be found, so it is necessary to conduct research to find out data related to B3 waste management from activities in the workshop. Therefore, a study was conducted which aims to identify the variety of B3 waste in the workshop and to know the management of B3 waste by the workshop. so it is necessary to conduct research to find out data relating to the management of B3 waste from activities in the workshop. Therefore, a study was conducted which aims to identify the variety of B3 waste in the workshop and to know the management of B3 waste by the workshop. so it is necessary to conduct research to find out data relating to the management of B3 waste from activities in the workshop. Therefore, a study was conducted which aims to identify the variety of B3 waste in the workshop and to know the management of B3 waste by the workshop.

2. Materials and Methods

In collecting data, field observations were made to the X workshop in the Surakarta area. Field observations were carried out on Wednesday, November 10, 2021 by conducting interviews with the workshop. The data obtained were then analyzed and processed by qualitative methods using literature studies from existing sources.

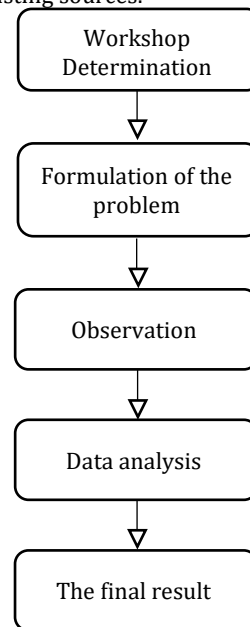


Fig.1 Flow of research

3. Discussion

3.1 Existence of Vehicle Types in Surakarta City (Explanation of research location (workshop))

Table 1
Number of Vehicles in Surakarta in 2020

Subdistrict	Total Area (km ²)	Motorcycle-cycles	Passengers Cars	Buses	Trucks	Total
Laweyan	8.64	73.044	13,360	228	3.994	90,626
Serengan	3.19	29,500	5,400	109	2,533	37,542
Kliwon Market	4.82	39,215	5.605	87	2,582	47,489
Jebres	12.58	76.024	11.246	254	5.685	93.209
Banjarsari	14.81	115.457	18,659	934	6,963	142,013
Surakarta	44.04	333.240	54,270	1,612	21.757	410.879

Source: Surakarta City in Numbers, 2021

Table 1 shows the number of vehicles by sub-district and type of vehicle in Surakarta City. Of the 5 sub-districts, Banjarsari District is the area with the highest number of vehicles, which is then followed by Jebres and Laweyan Districts. The comparison of the area of the Banjarsari and Jebres sub-districts is not too large, but the ratio of the number of vehicles is too far. Banjarsari District has the largest area, which is 14.81 km² or covering 33.62% of the Surakarta City area, with various accessible public facilities, such as Solo Balapan Station, Tirtonadi Terminal, Manahan Stadium,

Monument 45 Banjarsari, Solo Paragon Mall, and several other facilities.

The table also shows that the most commonly used types of vehicles, even in every area in Surakarta City, are motorcycles and passenger cars. In Banjarsari District, there are 115,457 motorcycle users and 18,659 passenger car users. People use two-wheeled vehicles more because they are fuel efficient, travel time efficient, comfortable, and do not need to pay additional fares like in public transportation (Sadono, 2015). In addition to relatively cheap and affordable product prices,

motorbikes are also one of the most possible alternatives in case of congestion (Nuriyanti, 2017).

3.2 Activities in the Workshop Industry

Based on data from the City of Surakarta in Figures 2021, the number of motorized vehicle users will increase every year, this also has an impact on the density of activity on the road. Every driver must prepare his vehicle in good condition, so as not to pose a safety threat to the driver and the surrounding community. Services in the form of vehicle maintenance and repair require special knowledge and expertise, so this work requires specific field specifications. The motor vehicle repair industry is also the answer to these problems. Currently, workshops and vehicles are 2 things that cannot be separated, so that services and facilities in a workshop will always be a consideration for the community (Wardhana, 2013).

According to the Decree of the Minister of Industry and Trade No. 191/Mpp/Kep/6/2001, motor vehicle general workshop is a workshop that functions to repair, repair, and maintain motorized vehicles so that they meet technical requirements and are roadworthy. In other words, a workshop is an automotive service facility that accommodates workshop activities, which include periodic service, engine oil changes, washing, and repairs to certain parts of the vehicle (DLH Surabaya City, 2019). Workshops can be divided into 3 classifications, including: (a) class I type A workshops; B; and C, (b) class II type A workshop; B; and C, and (c) class III type A workshop; B; and C. Type A workshops are workshops with facilities capable of performing periodic maintenance work, minor repairs, major repairs, and chassis and body repairs. Type B workshops are workshops capable of carrying out periodic repairs, minor repairs, and chassis and body repairs. While the type C workshop is a workshop that is only able to carry out periodic maintenance work and minor repairs. Especially for 4-wheeled vehicles (cars), the workshop is divided into 4 based on the type of service facilities. The workshops are dealer workshops, general service workshops, special service workshops, and mobile unit workshops.

Table 2

Details of the Number of People in Workshop X

No.	Position	Amount (Person)
1.	Owner	2
2.	Administration	3
3.	Mechanic	4

Bengkel X is one of the workshops located on Jalan Teuku Umar, Keprabon Village, Banjarsari District, Surakarta City. The results of the research conducted by workshop X included in the type C workshop, which only served minor repairs, Based on replacement, battery replacement, and minor modifications to 2-wheeled vehicles. 2 people as workshop owners, 3 people as administrators, and 4 savers as mechanics. Based on the type, this workshop is included in the type C workshop, which only serves minor repairs, oil changes, battery changes, and minor modifications to 2-wheeled vehicles. This workshop is managed by 9 workers and 4 of them serve as mechanics. Workshop X serves several customers, with a variable number each day. Activities at Bengkel X include several things, including buying and selling activities and motorcycle repairs.

The buying and selling activities that take place are carried out by 3 people at once with details of 2 administrators and 1 shopkeeper as shown in Figure 2. The shop located in Bengkel X sells various kinds of accessories and equipment needed by motorbikes, these accessories include tires, oil, lubricants, spare parts, tools, etc. as in Figure 2.

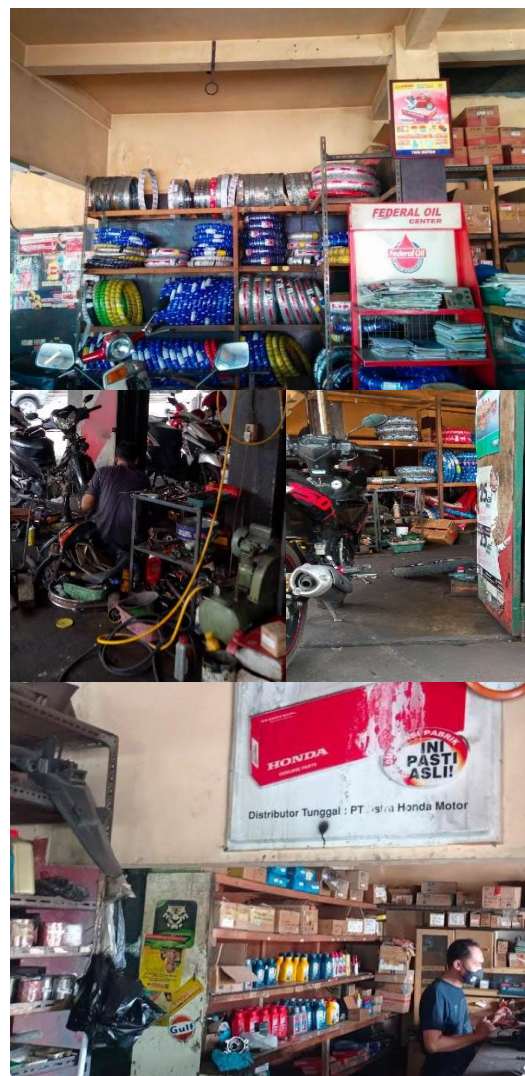


Fig.2 Activities in the Workshop Industry

Meanwhile, motor repair activities carried out by Bengkel X include changing tires, filling tires, changing batteries, changing oil, cleaning air ducts, checking vehicle brakes, checking and adding gas pressure, etc. as shown in Figure 1.

Although it can perform various types of repairs and maintenance on the motor. However, the activities that are most often carried out at Bengkel X are oil, battery and tire changes as shown in Figure 1 where Bengkel X provides many tires to replace customers' tires and some are sold.

3.3 Identification of Waste Characteristics and Generation (type and amount of waste generated, flow of waste management)

Besides having a positive impact by providing welfare for the community, workshops can produce waste that can damage the environment (Azharuddin et al., 2020). Waste from workshop businesses is heavily contaminated with oil and fuel. According to the LHK Ministerial Regulation Number 12 of

2020 concerning the Storage of B3 Waste, used oil or lubricants and batteries are one of the B3 wastes. Oil that has been used for engine maintenance will result in wasted used oil. The wasted waste can contain air, water and soil pollutants which will cause pollution that is very dangerous for the environment if not recycled. One liter of used oil can destroy millions of liters of groundwater, stripping the soil of nutrients (Herdito et al., 2021).

Table 3
Identification source of hazardous and toxic waste in Workshops X

No.	Name of Waste	Type		Description
		Liquid	Solid	
1.	Oil used	x		Derived from a used engine, vehicle oil change. Used oil is jet black and shiny
2.	Oil used bottle		x	Derived from a used engine, vehicle oil change. In the form of a bottle that has been exposed to oil
3.	Battery used		x	Derived from used vehicle batteries containing lead and sulfuric acid
4.	Used rags that are exposed to oil / leftovers		x	Oil change process

Workshop waste itself is classified into 3 categories, namely solid waste, gas waste and liquid waste. Gas waste is the result of burning fuel in motor vehicles. Solid waste can be in the form of used rags, used screws, pieces of metal, and others. Liquid waste in the form of used lubricants or used oil and batteries. B3 waste generated from the workshop is used oil waste, battery waste, and cloth waste. Used batteries collected at the X workshop are usually purchased by collectors or junkyards. Based on table 3 there is B3 waste generated from the workshop which consists of liquid waste and solid waste. Solid waste is in the form of used oil bottles, used batteries, and used cloth that has been exposed to oil. Liquid waste is derived from used oil or used lubricants from former vehicle oil change engines. The average waste of used lubricants or oil produced is around 25-30 liters per month. The used oil produced will be stored in buckets, then in a few months will be purchased by industries that need oil for the production process, For example, an industry that uses diesel will need oil so that the industry buys used oil at a low enough price so that it uses used oil. Based on observations in the field, the containers used to accommodate used lubricant waste or oil and batteries do not meet regulatory standards and the labeling on non-existent storage packaging is not in accordance with LHK Ministerial Regulation No. 12 of 2020 concerning Hazardous Waste Storage and Government Regulation No. 22 of 2020. 2021

concerning the Implementation and Protection of the Environment.

3.4 Analysis of hazardous waste management recommendations in the workshop

Hazardous Waste Management is an activity that includes reduction, storage, transportation, utilization, processing, and/or landfilling. From the observations, the workshop only collects B3 waste but it is still not in accordance with the applicable regulations. This recommendation is based on Permen LHK Number 12 of 2020 concerning Hazardous Waste Storage and Government Regulation No. 22 of 2021 concerning Environmental Management and Protection. The following are some management recommendations at the Workshop.

1. Reduction
 - Back to using used parts that can still be used.
 - Implementing the K3 system to avoid spills of lubricant or fuel from the motor so as to reduce the use of contaminated rags,
 - Use oil according to the volume required for the motor to be replaced.
2. Packaging and Labeling
 - Storage area made of metal or plastic that can package B3 Waste in accordance with the characteristics of B3 Waste, capable of confining B3 Waste to remain in the packaging and has a strong cover to prevent spillage during storage, transfer, and/or transportation and is located in a condition not leaking, not rusting, and not damaged.
 - Provide a symbol/label in accordance with the provisions in PP No. 22 of 2021 concerning the Implementation and Protection of the Environment.
3. Storage
 - The workshop B3 waste storage room must be protected from rainwater ingress.
 - The floor must be waterproof, not corrugated, strong and not cracked.
 - This workshop B3 waste storage area uses labels or warning signs for flammable materials that are useful for preventing fires from occurring.
 - Fire detection and extinguishing systems, water supplies for fire extinguishers and fire hydrants are in the workshop's B3 waste storage room.

B3 waste management at Bengkel X focuses on storing waste in buckets which are then sold to collectors or junkyards. Basically this management system does not cause pollution to the environment because it is not disposed of directly. However, it still has some drawbacks including:

1. The storage area is not up to standard. So the researchers suggest that the workshop owner should prepare a temporary shelter (TPS) in accordance with PP No. 101 of 2014 article 16 where the design and construction of TPS must have criteria of being able to protect waste from rain and sun, have lighting/ventilation, and have drainage channels (Nurhidayat). and Arinih, 2019). According to Azteria & Gani (2018), the building where the B3 waste is stored must have a sign indicating that the place is a place for storing hazardous & toxic waste.
2. An oil spill at workshop X caused the floor to look slippery, dirty, and black. If left unchecked, it can cause work accidents such as slipping of workers due to slippery floors. In this case, the researcher suggests socialization regarding the importance of work safety and immediately cleaning the oil on the floor (Sari et al.,

2021). Then, to prevent any more spills, it is better to apply an oil cross-section/ drainer, an oil funnel holder, and a component washer in addition to the fact that it does not require a lot of money to make and is also easy to operate (Rubino & Yasi, 2017).

3. Researchers suggest that B3 waste owners should cooperate with 3rd parties in B3 waste management who already have a permit from the Ministry of Environment & Forestry (KLHK) or before being sold, they should carry out B3 waste management stages in accordance with PP No. 101 of 2014, the stages are between others are sorting and storing, storing and labeling, then transportation (Wardhani and Triatmaja, 2021). This is so that the B3 waste that is disposed of does not experience mixing or contamination with other materials that can cause health and environmental hazards.

Some recommendations for workshops in B3 waste management (Chachorovski, Z. et al. 2017):

- Fabrics that have been contaminated with lubricants must be well dried
- If possible, provide a used oil filter to extend the life of the used oil as long as possible.
- For other liquid waste that has been contaminated with used oil, it can be collected and used as an additive to make cement or bricks.

Hazardous waste that is not managed with good planning will increase the condition of concern for the environment. For this reason, further discussions with workshop owners are needed to find out the obstacles encountered in the field and more case studies.

6. Conclusion

Based on the survey and explanation, it can be seen that workshop X produces B3 waste which can be classified into 3 categories. The first is gas waste in the form of fuel combustion in motor vehicles, then solid in the form of used rags, used screws, pieces of metal, and others. Finally, liquid waste is in the form of used lubricants or used oil and batteries. The workshop can accommodate 25-30 liters of used oil per month to be stored or purchased and utilized by other parties.

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