

## Environmental Conservation Through Waste Management of Car Repair Shop in Makassar City

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### ABSTRACT

This study aimed to determine: (1) description of car repair shop (CRS) waste management at Makassar city, (2) constraints faced by the manager of the CRS in waste management, (3) waste management efforts made by the manager of CRS, (4) the efforts made by the government in preserving the CRS clean environmental. The population is all CRS in Makassar (112 units). Data collection techniques using documentation, observation, and interviews. The results showed that (1) most of the CRS in Makassar not properly manage their waste (solid waste, liquid waste and waste gas or smoke), (2) the constraints faced by the manager of CRS in managing and treating waste, include: knowledge, education and training on how to manage and treat waste, (3) the effort made by the manager of a CRS in manage of waste include: providing a solid waste containment, making wastewater processing, drain waste water through pipe line, chimney installing, and maintain the cleanliness of the water or drainage channels, (4) the efforts made by the government in preserving the clean environment in form of: surveillance, monitoring, coaching, education, training, managing and treating waste

## INTRODUCTION

Development fundamentally changes what is considered to be superior to disadvantage, and environmental changes in new directions of balance. Development as an effort to improve welfare society, is basically an activity that utilizes resources nature and the living environment which have an impact on changes in function environment. Therefore, a pattern or technique for building a the economy will have a big impact on what will happen to environment (Ariesa, 2016; Amin and Saleh, 2022). According to Todaro (2003), environmental degradation can reduce the rate economic development and the level of productivity of natural resources as we ll the emergence of various kinds of health problems and comfort disorders life.

In fact, the objective of environmental development is to enhance environmental benefits while minimizing risks, ultimately improving living standards so people can live in a healthy, safe, and humane environment. The key environmental factors – soil, water, and air – are crucial for the well-being of people and other living beings (Mandra, et al.). The government's efforts in waste management, particularly within the industrial sector, focus on regulating the operations of industries that produce hazardous waste (Mandra et al. 2022).

## LITERATURE REVIEW

The most noticeable indicator of urban development today is the sharp increase in the number of motor vehicles. The growing population also contributes to higher transportation demands (Hendratmono, 2022). Car repair shops (CRS) in Makassar are generally individually owned and categorized as medium or small enterprises (Marbun, 2005). CRS activities typically involve vehicle maintenance and repair, welding, painting, and car washing (Sunardi, 2016). These activities have the potential to cause environmental pollution due to the waste generated, including solid waste, liquid waste, and vehicle emissions. (Mandra, et al. 2022).

CRS business activities have the potential to create environmental issues, including pollution and health problems. The significant amount of waste generated contains hazardous and toxic substances with dangerous properties. Workshop waste included in B3 waste includes leftover materials from the results of activities that are no longer used because they are damaged, leftover packaging, leftover items from the processing of damaged vehicles, as well as used oil that can no longer be used and requires handling and special processing (Akhmadi and Suharno, 2017).

Waste management must include sorting, containerization, transportation, and disposal (Tungka et al., 2022). According to Tamrin (1997), environmental awareness within the CRS system is relatively low. Other studies indicate that CRS activities in Makassar may negatively impact the environment, contributing to issues like noise, temperature changes, emissions, wastewater, and waste pollution (Chaeruddin, 1993). Additional research by Hashim (2004) confirms that CRS waste management in Makassar is generally inadequate, especially in handling emissions. Another study points out that CRS waste management in the city has not been fully optimized (Anwar, 2003). The main challenges faced by CRS include: (1) workshops lacking proper waste storage, (2)

insufficient knowledge about waste management, and (3) a lack of supervision from workshop managers, the government, and the community (Mandra, 2022). These issues lead to environmental degradation, with waste causing pollution around CRS facilities.

The objectives of this study were to: (1) assess the waste management practices in CRS, (2) identify the challenges CRS faces in managing waste, (3) examine the efforts made by CRS managers in waste management, and (4) evaluate the actions taken by the government to maintain the environmental quality around CRS facilities in Makassar.

## **METHODOLOGY**

This research was conducted in Makassar, South Sulawesi Province, in April-December 2023, with the number of a CRS in the sample as many as 112 units spread over 15 districts. This study uses a survey approach to describe the waste management and environmental condition of the CRS. The survey method is an intentional method used to collect the main data by using oral and written questions. This survey requires interaction and relationship between researchers and researchers to get the necessary data (Sugiyono, 2018).

The method of data collecting data collection using interviews and questionnaires provides workers and workshop leaders, government and community around CRS. The number of respondents of each CRS is 2 employees and 1 CRS manager. The data obtained (secondary and main data) will be described to get the answer to the proposed research questions.

## **RESULTS AND DISCUSSION**

### **CRS Characteristics**

Over the last three years, the number of motor vehicles (cars) in Makassar has grown by an average of 13.87 percent, driven by factors such as (1) population growth, (2) improved economic conditions, and (3) increased mobility of the population (Ding et al., 2019). This growth has created business opportunities in the vehicle workshop sector, although the annual growth rate of workshops is only 4.81 percent (Mandra et al., 2022). To open a workshop, several conditions must be met, including: (1) having a proper workspace, (2) being located outside residential areas, (3) having skilled and knowledgeable staff, and (4) providing necessary work equipment (Areaf, 2016). However, about 56.25 percent of vehicle workshops are located in residential areas or along major roads as a strategy to attract customers (Sunardi, 2016).

Research data shows that CRS activities in Makassar include: (1) service and repair (59.82 percent), (2) welding and painting (27.55 percent), and (3) car washing (12.63 percent). Service and repair dominate the activities, as regular car maintenance is essential. This aligns with Sunardi (2016), who states that CRS activities involve vehicle maintenance and repair, welding and painting, and car washing. The education level of car shop managers is predominantly high school (93.75 percent), as is the education level of mechanics (82.50 percent). With this education, they should have sufficient knowledge of hygiene and environmental

management. The level of education plays a crucial role in maintaining the surrounding environment (Sunardi, 2016; Mandra et al., 2022).

Waste generated by CRS activities is categorized into three types: (1) solid waste, (2) liquid waste, and (3) exhaust gas fumes. If not managed correctly, these waste types can harm the environment. The distribution of waste is as follows: solid waste (31.25 percent), liquid waste (62.50 percent), and exhaust gas fumes (6.25 percent). Solid waste storage is organized in various ways: (a) in open spaces for large quantities (68.75 percent), (b) in walled shelters (25.25 percent), and (c) in wooden shelters (6.00 percent). Used oil is stored in: (1) drums (90.63 percent), and (2) buckets (9.37 percent). Proper containers are used to store used oil to ensure effective waste management.

This is in line with the statements of Tungka et al. (2022), Workshop waste is waste that is included in hazardous and toxic waste (B3). Workshop waste included in B3 waste includes leftover materials from the results of activities that are no longer used because they are damaged, leftover packaging, leftover items from the processing of damaged vehicles, as well as used oil that can no longer be used and requires handling. and special processing (Akhmadi and Suharno, 2017).

For this type of waste / smoke is the result of the burning of fossil fuel, both gasoline cars) and a car provided by diesel can cause consequences such as eye irritation and shortness of breath. To avoid the impact of waste / smoke gas, only 6.25% of car repair workshops have permanent chimneys on the roof of the building. The presence of chimneys to help release air / smoke in the air. Other results have shown that only 2 car seminars (6.25%) provide a means to transport waste.

### **Barriers of CRS Manager in Waste Management**

Some of the factors causing the CRS manager who has not made waste management because:

1. Knowledge of Waste Management

Knowledge of waste management, influenced by education level, affects a person's ability to understand the importance of cleanliness in the environment, their role in managing it, and their commitment to ensuring that CRS activities do not harm the surrounding environment. CRS managers generally demonstrate considerable knowledge in waste management, with 0.62 percent showing knowledge of solid waste management, 66.63 percent of liquid waste management, and 93.75 percent of gas/smoke waste management.

2. Guidance on the Preservation of the Environment

The government's efforts in conservation of the environment have been implemented, for example by cooperating with CRS workers with some agencies, such as the Department of Health and Environmental Services. However, 81.25 percent, CRS manager admitted that he had never received advice and others received advice.

### 3. Guidance on Waste Management

The government has sought to improve the environmental quality around CRS through training of employees. The form of advice is done by enhancing waste classification, supplying barrels, transporting waste, removing waste and restoring. However, up to 75 percent said they did not receive the Council.

### 4. Training in Waste Management

The training is provided for managers to manage waste management including solid waste, liquid waste and gas pollution, although the training is not periodically. CRS claimed not to receive up to 90.63%. This is because, among other things, because: (1) The lack of time allowance for this activity, (2) has no budget to perform training.

### 5. Manager's efforts in Waste Management

Waste is produced by CRS, solid waste, liquid or gasfumes that cannot be thrown without being treated in advance so that it will not be poorly affected by the surrounding environment. It takes an effort to manage CRS in waste management. The results of the interviewers described that waste management efforts have not been optimally integrated. Waste management aspect include:

#### **Waste Sorting**

One of the efforts in waste management is the classification of waste classification and size (size) of waste such as solid urban waste, iron / plate, wood, tire, rubber, broken glass, plastic, hard cover, asbestos, seal, saw and tissue. Liquid waste such as engine oil, driving oil, gear oil, oil transmission, fat, water battery and brake liquid. CRS has made efforts to classify solid waste, liquid or gas / smoke that all the respondents are 6 respondents (57.1 percent). The packaging in the form of drums, barrels or containers used must be in good condition, not leaking, not rusty or damaged, made from materials that are suitable for the characteristics of the hazardous waste to be stored, able to secure the waste stored therein, have a strong cover to prevent spills when transfer or transportation (Nadeak et al., 2015).

#### **Provision of the Waste Disposal Site**

Efforts made by CRS managers show that 93.75 percent have provided solid waste storage in various forms, including open spaces, walled shelters, and wooden structures. Used oil and wastewater (100 percent) are stored in containers such as drums, buckets, and jerry cans to prevent seepage into the ground and contamination of water. However, for waste gas/fumes, 100 percent of CRS managers reported that they have not provided storage or disposal solutions. The waste storage process after completing vehicle repairs will immediately be collected in the respective storage areas and the storage areas used are gallons or drums for storing used oil and used tires only placed on the side or front of the workshop. The requirements for waste storage are that the storage area must be in accordance with the characteristics of the waste and the waste storage location must be equipped with channels and be able to accommodate the waste produced (Arief, 2016).

The liquid waste container serves as a temporary storage for hazardous and toxic waste (B3), which is then transported to a waste disposal facility for further processing. The liquid waste from workshops contains fatty oils, COD, and BOD. To prevent this waste from harming the environment, especially if released into water bodies, proper treatment is required. One method for processing fatty oil is by using a grease trap (Wijayanti and Purnomo, 2023).

There are several factors that cause CRS managers not to carry out waste processing, including: (1) high costs, (2) the lack of involvement from the government and other parties in providing education and training on waste management in workshops, (3) low awareness among managers regarding pollution caused by car repair waste, (4) insufficient guidance, monitoring, and supervision from the government, community, and non-governmental organizations, and (5) the absence of penalties or sanctions for CRS managers who fail to properly treat waste.

### **CRS Waste Transportation**

Not one of the respondent management of CRS said they did not provide a vehicle to transport the waste of CRS. The recommendation that can be given for the transportation aspect is that the transporter uses closed means of transportation, then in waste transaction activities they must also include documents stating the amount of waste taken and the type of waste taken (Adhikarsha, 2019).

### **Waste Collection**

Non-economic solid waste (garbage) is gathered at a temporary storage area located in front of the CRS workshop. About 81.25 percent of respondents reported that they sell waste materials from the car repair shop that still hold economic value, such as scrap metal and used oil. The proceeds from selling scrap metal are distributed among employees as a means to enhance their welfare and serve as a work incentive, even though some respondents mentioned the sales were intended to generate investment capital.

### **Waste Disposal**

Although most CRS facilities do not provide trash bins, residual waste is still often found scattered around the shop areas. While waste disposal facilities are intended to encourage proper waste management, in reality, some trash is still visible at CRS locations and along the roadside. Around 28.13 percent of respondents admitted that garbage is occasionally scattered, and 37.50 percent reported disposing of liquid waste into drains or drainage systems. This situation reflects the varying levels of awareness among CRS managers and employees, as maintaining cleanliness around CRS facilities aligns with public and government expectations to prevent environmental contamination. Additionally, 93.75 percent of respondents indicated that gas or fume waste is released at the roadside.

There is a prevailing tendency and habit of disposing liquid waste directly into sewers and ditches, under the assumption that these are appropriate methods of disposal. Similarly, solid waste management is not handled effectively, as only a limited amount of trash – such as cans, bottles, cardboard, plastic, and paper – is properly managed, despite being generated from CRS activities. These practices result in both solid and liquid waste posing environmental risks. Several factors contribute to this issue, including: (1) a lack of awareness among managers and employees about the harmful impacts of waste pollution, (2) insufficient guidance, monitoring, and oversight from the government, the public, and non-governmental organizations, (3) the absence of penalties for CRS managers who litter, and (4) a belief among some CRS managers that environmental cleanliness, especially regarding solid and liquid waste, is the government's responsibility – particularly since cleanliness fees are paid.

### **Waste Recovery**

Waste recovery efforts inadequate because only 21.87 percent to re-use iron/plate and wires are still in good condition. Some of the reasons: (1) reduce the volume of waste, and (2) reduce the cost of production, means increasing profits. Wastewater (100.00 percent) did not recover by CRS but is sent to a third party that has been determined according to law.

### **Supervision of CRS Cleanliness**

Maintaining cleanliness in the workplace is essential, as it helps to: (1) boost productivity, (2) prevent workplace accidents, and (3) reduce environmental pollution. Cleanliness can be sustained through consistent supervision, which gradually fosters a culture of clean behavior. Oversight by CRS management has resulted in improved sanitation conditions, as evidenced by 100% of respondents confirming that leadership plays an active role in monitoring cleanliness.

### **Provision of Sand or Sawdust**

To keep the floor clean during service or repair activities, CRS workers use sand or sawdust to absorb oil spills or puddles. This method is commonly used because both materials have relatively good absorption properties for oil and grease, making it essential to keep at least one of them readily available. Approximately 93.75 percent of CRS facilities have sand or sawdust stored for this purpose. This practice reflects their commitment to maintaining cleanliness and preventing soil and water contamination caused by oil seepage.

### **Ability Waste Shelters**

The capacity of CRS waste storage is an important indicator of: (1) the level of commitment of shop managers to environmental sustainability, and (2) the volume of activity in the car repair shop. Adequate waste storage is crucial – if the storage is too small relative to the volume of work, it will not be able to contain the waste over time, leading to overflow and scattered waste. In this regard, all respondents (100 percent) indicated that their waste storage facilities are sufficient to hold the waste generated over a one-month period. According to Adhikarsha, (2019), procurement of storage containers is a place to collect waste according to type and characteristics so that it does not mix with other waste.

### **Provision Chimney**

Efforts to provide equipment for machine performance testing and tools to measure exhaust gas levels are necessary. However, in reality, many companies do not possess such equipment. Several reasons contribute to this, including: (1) the high cost of testing machines and exhaust gas measurement tools, (2) the importance of these tools in producing data or proof regarding whether a vehicle is fit for operation, and (3) the low demand from customers for testing and measuring vehicle exhaust emissions.

In order for the car to remain in good condition, several conditions must be observed, including: (1) always in the default state, (2) running the vehicle without power, and (3) carrying out regular tune-ups or repairs, thereby preventing damage. Disorders caused by exhaust gas, such as smoke, include symptoms like shortness of breath and eye irritation. To reduce the amount of smoke generated, only 6.25 percent of CRS have installed chimneys to direct the smoke into the air. Meanwhile, 93.75 percent have not installed chimneys, citing the high costs of installation and the belief that the smoke does not pose a significant disturbance to the public.

#### **6. Government Efforts in Environmental Care**

In addition to the efforts made by CRS managers in managing waste, the municipal government of Makassar also strives to maintain a clean and healthy environment. Actions taken by the Department of Industry, Trade and Investment Cooperation, along with the Department of Environmental Management, aim to preserve environmental quality through the following measures: (1) ensuring that all CRS facilities possess a valid business license, (2) providing counseling and guidance to CRS managers in accordance with environmental management documents or the Environmental Management Statement Letter (SPPL), which is a required document during the business license application process, (3) offering training to CRS managers to enhance service quality and proper waste management, and (4) conducting regular supervision and monitoring of waste management practices.

Several requirements must be met to obtain a business license for CRS, including: (a) having a proper and adequate workspace, (b) being located outside of residential areas, (c) employing qualified staff with expertise or experience in their field, (d) having the necessary work and safety equipment, and (e) imposing sanctions, including closure, if the CRS continues to violate regulations despite receiving coaching, counseling, training, supervision, and monitoring.

#### **7. The government's efforts in environmental conservation**

The government has made efforts to maintain environmental cleanliness through the development of waste management training. Supervision and monitoring are prioritized to prevent potential environmental contamination and to enforce sanctions on car repair shop managers who pollute the environment and neglect the cleanliness of their workshop areas.

Automotive workshops (for cars and motorcycles) generate several types of hazardous and toxic waste (B3). B3 waste is highly dangerous because it is corrosive, flammable, explosive, reactive, toxic, infectious, and an irritant. The

activities in automotive workshops involve numerous materials that have the potential to create such waste.

In parallel with urban and regional development, the volume of waste generated by workshops continues to rise as the number of motorized vehicles increases. Due to this increase in volume, action or supervision must be taken to prevent environmental pollution by workshop waste (Hertien and Wahyu, 2004). Solid and liquid waste can later make the air polluted, even if inhaled by workshop workers, it can cause respiratory problems. To overcome the impacts, it is necessary to manage workshop waste (Soemarwoto, 2004).

The basic aim of waste management is to carry out routine management. Waste management includes storage, transportation, and the management process up to waste disposal. This is done to ensure it is safe for the environment and focuses on efforts to overcome direct threats that can be posed to public health (Amadi et al, 2017). One material that falls into this category is oil. Used oil from vehicle operations, maintenance, and repair processes is commonly referred to as waste lubricating oil. This waste contains substances that can pollute the air, soil, and water. When spilled on the ground, used oil can contaminate groundwater and pose a significant environmental threat. This is due to the fact that waste lubricating oil can deplete soil nutrients, making it harmful to the environment (Darmono, 2001).

## CONCLUSIONS AND RECOMMENDATIONS

Based on the results of research and discussion, it can be drawn some conclusions as follows:

1. Waste management in Makassar CRS is carried out as follows: (1) solid waste is deposited in open areas, (2) liquid waste is stored in containers such as drums and cans, and (3) exhaust pollution is released into the atmosphere through chimneys.
2. Challenges faced by CRS managers in waste management include: (1) a lack of knowledge about waste management practices, (2) insufficient education on environmental and waste management, and (3) a lack of training specifically focused on CRS waste management.
3. Efforts made by CRS managers in waste management include: (1) sorting waste, (2) providing storage shelters for solid waste, wastewater, and exhaust gases, (3) reusing some types of waste, and (4) using sand or sawdust to clean floors from grease or oil spills.
4. Government efforts in environmental maintenance include: providing guidance and counseling on environmental and waste management to CRS managers, offering training on how to create waste processing systems, teaching how to build chimneys for releasing gases or fumes, conducting supervision and monitoring of CRS that show potential for pollution, and imposing sanctions on CRS managers who neglect environmental cleanliness.

## **FURTHER STUDY**

Future research can be related to vehicle exhaust emissions, vehicle noise levels, and vehicle and workshop waste management. By expanding the scope of research and considering these factors, further research can provide deeper insights and more applicable results to optimize the study of workshop and waste management and the effects caused more precisely.

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