

Industrial Waste Study in Rawang Industrial Area

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Abstract: *In Malaysia, industries wastes comprises about 30% of the total solid waste generated. At present, most of the industrial wastes are disposed either at open dumpsite or sanitary landfill. Under the Solid Waste Act 2007, the Malaysia government are encouraging private sectors to participate in voluntary waste minimisation plan. So, it will be just a matter of time before the government make it mandatory to practice waste minimisation in the private sector. There are many benefits from practising waste minimisation such as reduction in waste collection and tipping fee, reduce dependency on natural resources, reduce risks of polluting the environment and so on. Therefore, the main objectives of this study are to identify the types of waste generated and also to study the current practice of solid waste management in Rawang industrial area. Survey questionnaires and interviews are conducted to collect these information. The findings are many companies do not have dedicated personnel involved in solid waste management and the waste composition varies widely depending on the nature the industries. The most common types of waste generated by industries are mixed papers (26%), corrugated carton (18%), metal and cans (10.4%), plastics (8%), wooden pallets (8%) and mixed waste (18%). This study will be useful for planning future waste diversion program for industrial areas.*

Keywords: *industrial wastes, waste composition, recyclable materials*

1. Introduction

The amount of municipal solid waste generated in Malaysia is increasing each year due to population growth, economic advancement, industrialization, urban migration and high influx of foreign workers and students [1]. The problem is worsen by unsustainable practice of disposing municipal solid waste in the landfill as well as illegal dumping. Besides than that, there are lots of environmental burden associated with high amount of solid waste generated such as air pollution, water pollution, poor aesthetic view and threat to environmental sustainability.

Even though, Malaysia government has started to enforce the Solid Waste Management Act (Act 2007), it is still at an early stage where their main focus is on the household and commercial waste [2]. In addition, collection and transportation services of household and commercial waste in Peninsular Malaysia have been fully privatised and closely monitored. However, industrial waste collection services are not regulated and industries can appoint their own contractor for waste collection service.

Although, Act 2007 encourage business and public participation in waste minimisation practice, compliance seems to be limited due to lack of enforcement mechanism in place [2,3,4]. Lack of publication on cost estimation and solid waste management planning also indicates that much attention need to be paid on the importance of cost planning for solid waste management in industrialising regions [5].

Malaysia is reported to be among one of the largest waste generating industrial sectors in Southeast Asian areas [6]. Industrial waste in Malaysia comprised of 30% of total municipal solid waste collected and it was projected to increase 4% per year [7,8]. Since raw materials are used in manufacturing new products, there might be excess or rejected parts that can be used for recycling purposes. Excessive use of raw materials will cause extra burden on the environment.

In order to achieve sustainable industrial activities, industry players should therefore be efficient in usage of resources by replacing non-renewable materials with renewable materials and modify goods production and services with less negative effects on environment [9]. In addition, sustainable solid waste management requires the cooperation of every waste management practitioners involved with suitable methods [10]. The key strategies for production and recycling networks are resource and energy efficiency [11].

The large and medium industries located in identified (conforming) industrial areas still have some arrangements to dispose solid waste. However, the problem persists with small scale industries. In the cities and towns, small scale industries find it easy to dispose waste here and there and it makes difficult for local bodies to collect such waste on though it is not their responsibility [12]. For some industries, they disposed the wastes through burning in their factory compound or dumped into bushes, plantation or stored in the warehouses [8]. The aim of this research is to study the current industrial solid waste management practice in Rawang industries area. The objectives are as follow:

- i. To determine the availability of dedicated personnel for solid waste management
- ii. To study the industrial waste composition and common recyclable items.
- iii. To study the relationship between number of employee and the amount of waste generated.

It must be noted that not all the information collected is accurate because some of the data is on estimation basis. The number of employee is based on approximate and not the actual number of employee. Majority of industries surveyed were able to identify the main types of waste generated through their respective production process, but other types of wastes which are generated in smaller quantities were not mentioned.

2. Methodology

Survey, on-site observation and semi-structured interview were carried out in this research. A total of 100 copies of questionnaires were distributed through fax, email and by hand. However, only 29 companies responded. The respondents were from different position such as of project manager, supervisor, engineer, safety and health manager and administration manager. The companies chosen are confined in Rawang.

In this study, a combination of open and closed questionnaire approach was adopted due to the fact that some questions allowed the respondents to answer in the format preferable by them. The answering technique designed for the questionnaires structure is “selective based” as this technique is more convenient for the respondents to answer in the shortest time. Respondents just have to tick in the appropriate box.

The questionnaire contains 11 selective questions and 2 open ended questions. It is divided into two parts. The first part consists of two open ended questions which aim to get information on the total of waste generated in their company while the second part consists of questions to gather information on how the companies manage their solid waste at present.

3. Results and Discussion

3.1 Availability of Dedicated Personnel to Monitor Waste Management

Out of 29 respondents, only 10 respondents indicated that there was a specific person responsible to oversee the waste management practice in their industries. The position of the person-in-charge varies between companies, i.e. from Managing Director to Production Manager. The other 19 industries surveyed stated that none of their personnel were dedicated to manage their solid waste.

Commitment from top management is very important in implementing waste recovery plan. From the study, it was found out that industries with dedicated employees for solid waste management tends to have recycling programs while those without, tends not to have recycling program. So, it is very difficult to carry out waste recovery plans if the company does not have experienced and dedicated personnel to carry out the tasks.

3.2 Waste Collection Frequency

Waste collection frequency varies significantly according to type of waste generated, amount of waste generated and product demand. Waste materials generated in large quantities, such as mixed papers and cartons boxes, are generally disposed on daily basis. **TABLE III,II,I** shows the collection frequency by waste types.

TABLE 3.2.1 Main Waste and Collection Frequency

Waste Types	Typical Collection Frequency
Mixed waste	Daily, 2-3 times per week
Waste paper	Daily
Wood Pieces, sawdust (from Furniture Industry)	Daily
Scrap metal (from Metal Industry and Machinery)	Weekly
Waste Plastics (from Plastic Industry)	Monthly
Recyclables	Weekly/ Monthly (depending on production)

Waste collection frequency can be reduced if the company can retrieve more recyclable items from the waste stream. Reduction in waste collection frequency will results in less money spend to disposed the wastes as the waste collection fees are based on per collection trip (range from RM150 – RM220 per trip). Therefore, it is very crucial for the industry to know what types of waste they are generating.

3.3 Industrial Solid Waste Composition

Generally, the industrial wastes consist of paper based wastes such as shredded papers and corrugated carton boxes, plastic based wastes such as plastic bags and container, wood based wastes such wood pallet, sawdust, woodcut and timber, expired foods, metals, fabrics, rubber, cartridges and mixed wastes.

Fig. 3.3.1 shows the breakdown of waste generated from 29 industries in the research area. It illustrated that paper based wastes contribute the highest percentage of waste generated, which is 44%, followed by mixed wastes (17%), plastic based wastes (12%) and wood based wastes (12%). Metal and cans comprised of 10% of the total waste generated and the remaining types of waste such as expired food and others i.e. fabric, rubber and cartridges is approximately 4% and 1% each.

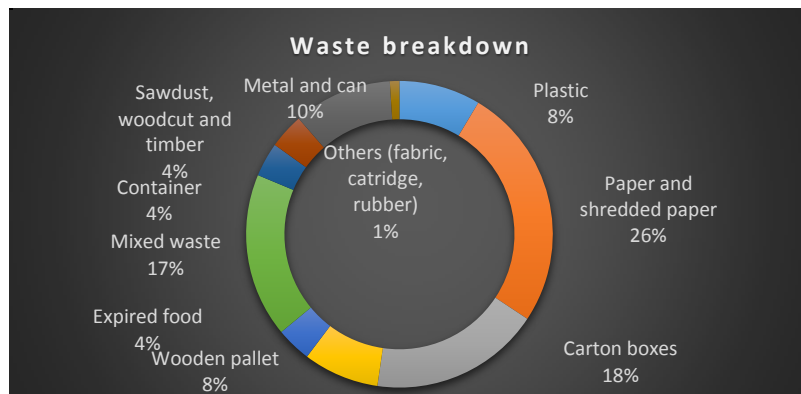


Fig. 3.3.1 Breakdown of waste generated

3.4 Breakdown of Waste Generated by Different Industry

The 29 industries interviewed were group based on industry types, such as food and beverage industry, petrochemical industry, furniture and furniture parts industry, machinery and engineering support industry, plastic industry, paper, printing and packaging industry and metal industry.

TABLE III,IV,I shows that both furniture industry and food and beverage industry are the largest waste generator. In the meantime, plastics industry has the highest number of employees, ranging between 100 and 1200 employees.

TABLE 3.4.1. Waste Generation per Industrial Category

Industry Type	No. of Industries Surveyed	No. of employees*	Average waste generated per industry (kg/ month)
Food and beverage Industries	2	2,500	9600
Chemical & Petroleum Industries	3	430	6400
Furniture & Furniture Parts	1	800	9600
Machinery and Engineering Support	8	1,850	8400
Plastics Industries	8	3,561	9200
Paper, Printing & Packaging	3	1,550	8533
Metal Industries	4	1,050	8000

*Number of employee and data of waste generated are based on estimation provided by the 29 respondents.

3.4.1 Food and Beverage Industries

Approximately 50% of the waste produced are from the expired and rejected food products as well as excess raw materials used in the food and beverage production processes. In addition, these industries also have recyclable materials such as paper and plastics which are usually sold to individuals or given to charitable organizations. An overview of the different types of waste generated by these industries is illustrated in **Fig. 3.4.1.1** below:

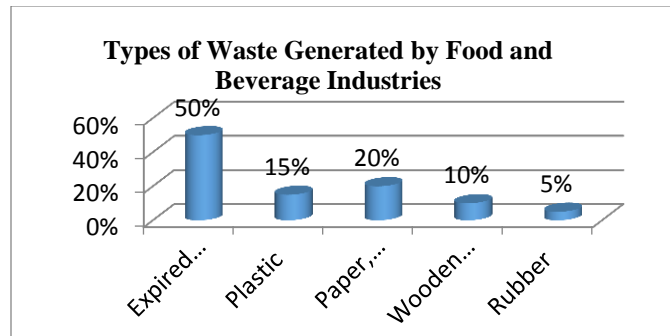


Fig. 3.4.1.1 Different Types of Waste Generated by Food and Beverage Industries

3.4.2 Metal Industries

There are four respondents under this category. Even though, these four industries manufacture different type of end products, waste produced is anticipated to be quite similar. **Fig. 3.4.2.1** shows the breakdown of the waste produced by metal industries.

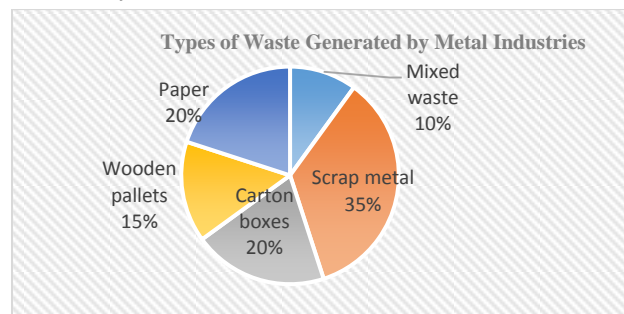


Fig. 3.4.2.1:Percentage of different types of waste generated by metal industry.

Scrap metals recorded the highest volume of waste generated in this industrial category followed by paper and carton boxes. Scrap metals are considered valuable commodities by these industries. Due to attractive market price of metal and high demand from upstream metal product producers, many waste collectors and recycling agents will approach these companies to get the scrap metals as well as the paper and carton boxes. It can be estimated that 75% of the waste generated is being recycled.

3.4.3 Paper, Printing and Packaging Industries

The main type of waste produced is waste paper. All respondents segregated their waste paper to get the highest possible selling price from recycling agents. As a result, majority of respondents were able to provide good estimation on the amount of waste paper generated by their respective company. An overview of all the types of waste produced in this industrial category is presented in Fig. 3.4.3.1.

Generally, printing companies are generating lesser amounts of waste in comparison to manufacturers of paper products. All respondents engaged private contractors to manage their waste. Non-paper based waste is generally treated as mixed waste and managed by their respective contractors. It can be concluded that 85% of the waste is being recycled.

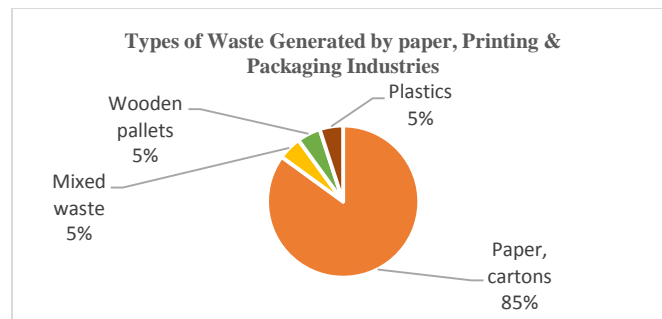


Fig. 3.4.3.1: Types of Waste Generated by Paper, Printing & Packaging Industries

3.4.4 Plastics Industries

The eight companies surveyed under this category manufacture a wide range of plastic products, for example plastic bags, poly bag, plastic tanks, plastic container and plastic pipes. These respondents provided sufficient information for estimating the amount of waste generated.

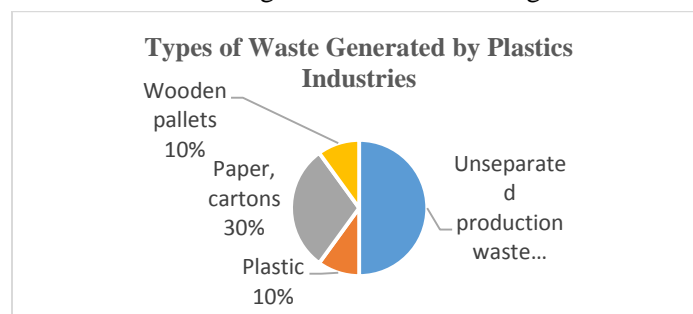


Fig. 3.4.4.1: Types of Waste Generated by Plastic Industries

The high percentage of un-separated production waste is caused by the lack of detailed information on the other waste breakdown. The percentage of unseparated production waste is estimated based on total storage capacity, collection frequency and information obtained on the main types of waste generated.

Majority of respondents stated that their waste plastics are generally collected together with other types of waste. However, some companies give recyclable materials such as waste paper, carton boxes

and waste plastic to charity organizations free of charge as part of their companies' corporate social responsibilities. Others will sell their recyclable items to their recycling agents.

3.4.5 Furniture & Furniture Parts Industries

There is the only respondent under this category, which is a wood-based furniture manufacturer. The respondent identified sawdust as the main type of waste generated followed by wood cuts and waste timbers. **Fig. 3.4.5.1** shows the breakdown of sawdust, wood cuts and waste timber.

Instead of disposing the sawdust into landfill, it is used as fuel to run the boiler. So, the remaining 27% of waste such as woodcuts and waste timber are disposed to landfill.

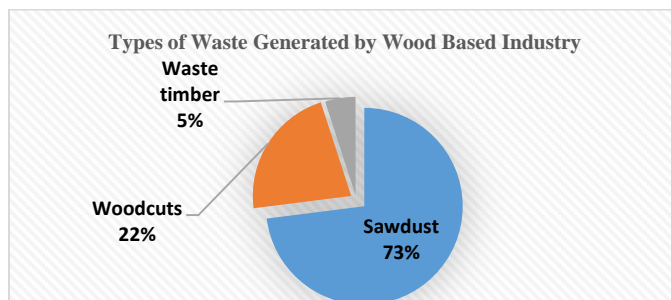


Fig. 3.4.5.1: Breakdown of Waste Generated by Wood-based Industry

3.4.6 Petrochemical Industry

The most common types of waste generated by this industry is paper and corrugated boxes from packaging of raw materials followed by plastics. Besides than non-hazardous wastes, petrochemical industries also generate hazardous or scheduled wastes.

According to the Environmental Quality (Scheduled Wastes) Regulation 2005, scheduled waste must be stored separately from non-hazardous waste. Companies in this category generally relied on collector agent for waste collection and disposal services. Even though, they have recyclable items, not all are being recycled. **Fig.3.4.6.1** shows the breakdown of non-hazardous waste generated by petrochemical industry.

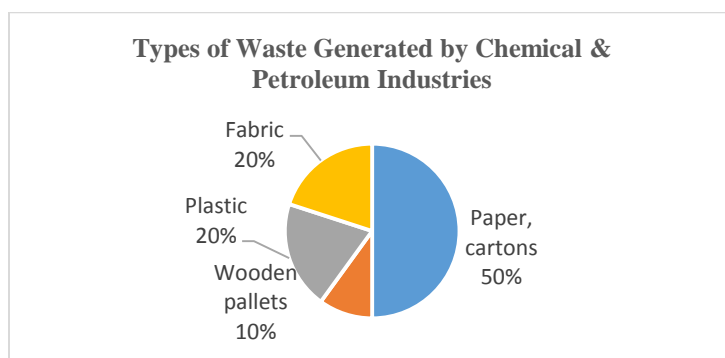


Fig. 3.4.6.1 Breakdown of Waste Generated by Petrochemical Industry

3.5 Relationship between the Number of Employees and the Amount of Waste Generated

Analysis was done to measure the relationship between number of employees and amount of waste generated at respective industry. It was found out that the relationship is weak as per **Fig.3.5.1** below. This means that total number of employee is not the main contributor to the amount of waste generated.

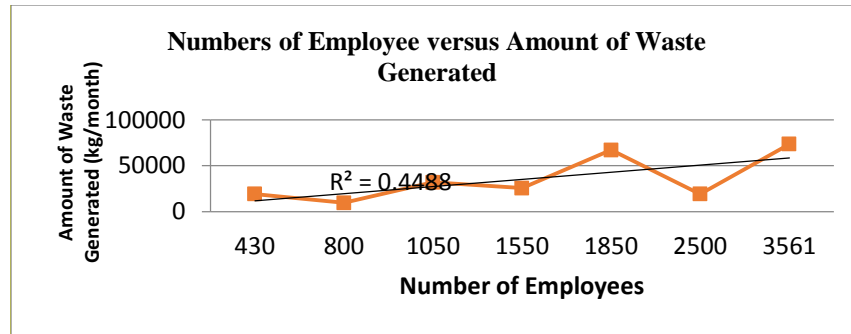


Fig. 3.5.1: Relationship between the numbers of employee versus amount of waste generated

The figure above shows the regression line on the scatter diagram. The correlation of number of employees and with amount of waste generated is 0.68. There are positive correlation indicates that both variables increase or decrease together. The number of employees increases while the amount of waste generated also increase together. An R-square value of 0.4488, it explains as 44.88% of the total variation in the data about the average. The R-square value is low which indicate that the relationship between number of employee and amount of waste generated is weak. Number of employee does not influence much on the waste generated. Most of the solid wastes come from the production and input materials.

4. Conclusion

Industries in Malaysia is given the opportunity to appoint their own waste collectors and due to lack of enforcement, very few are practising recycling activities at their premises. Only 10 out of 29 respondents have dedicated personnel to monitor their waste management activities. Without dedicated personnel, it is quite difficult to conduct efficient waste minimization activities. The most common types of waste generated by industries are mixed papers (26%), corrugated carton (18%), metal and cans (10.4%), plastics (8%), wooden pallets (8%) and mixed waste (18%).

However, it is notably that some of the company surveyed have segregated their wastes to retrieve recyclable items such as waste paper, carton boxes, waste plastics and scrap metals. They either request recycler agents to collect these recyclable items or donate them to charity organizations. There are potentials of diverting other recyclable items such as wooden pallets, woodcuts and expired food products which are not been done at present. Wooden pallets and woodcuts can be used either as fuel or construction materials while expired food products can be used for composting to product fertilizer.

5. Acknowledgements

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6. References

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