STUDY ON SOLID WASTE MANAGEMENT AND ANALYSIS IN

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ABSTRACT

Knowledge on solid waste generation, management and handling is necessary for an accurate decision making in the management strategy of urban waste. In Malaysia, the disposal of waste is under the legislation of Environmental Quality Act, 1974. The objective of this study are to investigate the solid waste generation and management within Taman Indera Sempurna, Kuantan, to investigate the level of recycling practice and awareness of its benefits and the importance among the residents at Taman Indera Sempurna, and to provide recommended solutions to improve solid waste management, handling and to promote recycling initiatives among the residents. This study also verifies the relationship of socio-economic status and lifestyles that influence the amount of waste generated along with their waste disposal behavior. A total of 50 copies of questionnaires will be handed to randomly selected residents regardless their race, age, education level and even their level of income. Judging by the study, both the solid waste management and handling in Taman Indera Sempurna can be classified as adequate. Awareness of recycling among the residents shows a moderately positive result where the respondents are able to acknowledge the benefits of recycling culture. The recommendations such as the establishment of solid waste recycle centre, the enforcement of law and reducing the usage of plastic bags have been made to boost the effectiveness and efficiency of current solid waste management, handling, and recycling as well.

ABSTRAK

Pengetahuan mengenai generasi sisa pepejal, pengurusan dan pengendalian diperlukan untuk membuat keputusan yang tepat dalam strategi pengurusan sisa pepejal bandar. Di Malaysia, pelupusan sisa adalah di bawah undang-undang Akta Kualiti Alam Sekeliling, 1974. Objektif kajian ini adalah untuk menyiasat penghasilan sisa pepejal dan pengurusan di Taman Indera Sempurna , Kuantan, untuk menyiasat tahap amalan kitar semula dan kesedaran manfaat dan kepentingan di kalangan penduduk di Taman Indera Sempurna , dan juga menyediakan penyelesaian yang disyorkan untuk meningkatkan keberkesanan pengurusan sisa pepejal , pengendalian dan menggalakkan inisiatif kitar semula di kalangan penduduk. Kajian ini juga mengesahkan hubungan status dan gaya hidup yang mempengaruhi jumlah sisa yang dihasilkan bersama-sama dengan tingkah laku pelupusan sisa sosio -ekonomi. Sebanyak 50 salinan boring soal selidik yang akan diserahkan kepada penduduk yang dipilih secara rawak tanpa mengira, umur, tahap pendidikan bangsa dan juga tahap pendapatan. Berdasarkan kajian itu, kedua-dua pengurusan sisa pepejal dan pengendalian di Taman Indera Sempurna boleh diklasifikasikan sebagai mencukupi. Kesedaran kitar semula di kalangan penduduk menunjukkan hasil yang sederhana positif di mana responden dapat mengakui manfaat budaya kitar semula. Cadangan telah dibuat untuk meningkatkan keberkesanan dan kecekapan pengurusan sisa pepejal semasa , pengendalian, dan kitar semula juga.

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INTRODUCTION

1.1 Project Background

Malaysia had experiencing rapid economic growth and urban transformation over the last decade. The amount and types of solid waste have increased tremendously prior to the economic growth and the improving living standard. According to IMPAK.(2006), each Malaysian generates an average of 1.7kg of solid waste daily, especially in major cities. If the solid waste were collected in daily basis, it is estimated to be more than 15000 tones, which is equivalent to the height of 4 times Kuala Lumpur Tower. Solid waste has been managed traditionally over 30 years by burying it in landfills with no special initiative to study the adverse effect and the potential energy of solid waste. In the year of 2007, the Government of Malaysia implemented a comprehensive and efficient solid waste management and public cleansing act. Federal department which is the Environment and Public Health Organization together with non-governmental organizations have been working side by side to tackle the solid waste generation problem, Ms. Janet J Balong. (2008) Trienekens.

As we know, a more congested area will produced more solid waste. As a result, a residential area in the urban area will be the subject for this study. Taman Indera Sempurna located near Kuantan will be the exact location for this study. The rate of solid waste generation in residential areas in Malaysia is increasing day by day. This rate varies depending on the economic status of that areas, the per capita solid waste

generation varies from 0.45 to 1.44 kilogram per capita per day (3). Based from the data produce by Ministry of Housing and Local Government (MHLG).(2000), the national average rate estimated for year 1991 to 1993 was about 0.711 kilogram per capita per day. This average has been increased to 0.8 kilogram per capita per day between years 1994 to 1999 and further increased to 1.5 kilogram per capita per day in year 2000. As for the year 2003, the national average for waste generated per person is approximately 4.5 kilogram per day, Ministry of Housing and Local Government (MHLG). (2003).

1.2 Problem Statements

The rapid growth of economy in Malaysia over the years has really affected the country in terms of increasing solid waste generation being produced from day to day. Malaysia is not facing alone regarding this problem, in fact, other fast developing countries such as China and India were also facing the same problem. The increasing of solid waste generation here in Malaysia has triggered the decreasing capability of landfill areas in Malaysia to contain the increasing solid waste generation.

Furthermore, this problem also had affected residential areas here in Malaysia in terms of the decreasing efficiency of the solid waste management in residential area that lead to several problems such as foul odours, dirty environments, and disease spreading. This problem also had increased the total cost to manage solid waste generation and this matter can getting worse if counteract measures did not being implemented.

1.3 Project Objectives

There are several objectives to be obtained throughout this study:

- To study solid waste generation management in Malaysia
- To collect and study all the related data about the respondents' background, solid waste management and as well as public awareness about environmental issues.
- To analyze all the data regarding solid waste management provided by the randomly selected respondents.

1.4 Project Scope

- Data collections from the community at Taman Indera Sempurna, Kuantan.
- Randomly distributed questionnaires to the community in Taman Indera Sempurna.
- Data collection and analysis for background details of respondents, solid waste management at Taman Indera Sempurna, Kuantan and the level of public awareness.

1.5 Significant Of Study

The increasing solid waste being produced day by day had really cause serious troubles towards the solid waste management system especially in residential areas. This study is really essential for the future of solid waste generation in Malaysia. All the data being obtained from this study can be the basic guideline in order to implement the improvements approach for solid waste generation in Malaysia. This study also can be use to educate and inform the society especially the residents in residential areas about the importance of reducing solid waste generation from their homes and also data about what types of solid waste that can cause harm to their surroundings. Lastly, this study can be use as an inhibitor in maintaining sustainable landfill areas for the future of solid waste generation in Malaysia.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

As being stated by Hassan, M.N. and Chong, T.L. 2000, all the data gathered on solid waste composition was mainly on the physical characteristics. Statistics gathered by the government indicated that the average amount of organic wastes for high income areas like Petaling Jaya and Kuala Lumpur was approximately 48.32 percent. This is followed by paper (23.56%), plastic and rubber (9.37%), metal (5.93%), wood (4.82%), glass and ceramics (4.03%) and textiles (3.97%). Generally, waste generation and composition vary with the degree of affluence and urbanization. Both the quantity and composition of solid waste vary widely from day to day and also seasons of the year not only between countries, but also between neighboring localities and between different types of properties within the same town.

The handling and separation of wastes at the source is a critical step in waste management. The storage of waste at source used various types of bins such as a small bin (household), medium bin (communal bin) and large bin (hauled communal). The most used bins for residential areas are small bin. Also, the bins used are of various materials, such as metal, plastic, rubber, concrete bin, and cardboard boxes, Zaini Sakawi and Gerrard, S.(2000). Waste collection activities are the most expensive activity in waste management systems. The cost of waste collection consists of two types whom are the direct and indirect cost. Direct costs include all the direct expenditure incurred in the

management of solid waste in an area. It also includes the resources used in the administration, development and operations of waste management right from storage to collection, transportation and disposal. Conversely, indirect costs refer to external cost incurred in practicing existing waste management systems. These costs include the environment damage cost of hazard storage, and collection disposal practices.

The efficiency of collection systems would have immediate impacts on the level of solid waste management services in an area. Poor collection would affect public confidence in the services. The public is very sensitive to collection services. Most complaint received is related to the quality of collection. The frequency of collection varies from daily to three times a week. Everyday collection is normally practiced in city centers, commercial areas and public areas as being stated by Zaini Sakawi, Gerrard, S., Andy, P.Jones, and Kadaruddin Aiyub,(2002). In the wider perspective, direct haulage from collection point to disposal sites without any intermediate treatment is the current practice in Malaysia. Some local authorities are at the beginning stage with the problem of getting suitable land for disposal sites as land is getting scare and there is a very high cost of land acquisition. The introduction of intermediate treatment facilities such as transfer stations, composting and incinerator plants may become alternative treatment of waste in the future. The government is also considering the various designs and mode of incineration process available in the market. One such process is the thermal gasification process. Consideration is particularly given to the technical and financial viability of the process to local conditions.

The implementation of waste management hierarchy approach in developed country is very common. Study by Arner, R. (1999). Northern Virginia and Thurgood, M. (1996) showed the successful implementation of the waste management hierarchy for solid waste management. The limitation of data and information for waste management hierarchy in Malaysia has placed a barrier for the Government to implement this approach. As for the sake of long term future planning and management, the Government should consider a combination of the various technologies to opt for an integrated

approach according to the composition solid waste generation here in Malaysia. In order to implement this approach, Malaysia should consider these several options for solid waste management hierarchy.

The quantities of solid waste generated and collection are significant to facilitate the efficiency of waste management in terms of establishing waste collection rates, disposal facilities and materials recovery facilities (MRFs). Tchobanoglous et al. (1993) cited that there are three factors that affecting waste generation rates:

a) Effect of source reduction and recycling activities
b) Effect of public attitudes and legislation
c) Effect of geographic and physical factors

Source reduction most possible occur by decreasing the size of products packaging, fabrication of product with longer lifespan or reuse materials to it extends. Besides, recycling program may relieve waste issues at all time since it reduce the amount of wastes collected.

A public attitude as well helps reduce the waste generated if people are willing to change their habits on keeps creating waste. Public education is essential in stimulation a change in public attitudes. Perhaps, existence of regulations concerning waste is an important factor that affecting waste generation.

Meanwhile, geographic location factor is related to climate. Malaysia itself is a tropical country thus continuously produces waste as the outcome to everyday life activities. The amount of waste is also in advance throughout the season festival and national celebration in comparing to the typical days.

2.2 Solid Waste Handling, Storage, and Processing At The Resources

2.2.1 Handling and Separation of Solid Waste

An effective approach to achieve the recovery and reuse of materials is by separating solid waste components (aluminum cans, glass, plastic containers and wastepaper). The public usually separated the components at home before convey the items to larger containers/recycling bin/nearby recycling center or sell to local buy-back buyer.

2.2.2 Storage of Solid Waste

Petts et al. (1994) and Peavy et al. (1985) named several features to be measured of the onsite storage of solid waste:

a) The effects of waste component storage
b) Type of container used
c) Container's location
d) Public health and aesthetics

Biological decomposition, absorption of fluids and contamination of waste components are the element to be considered as the effects of waste components storage. Types of containers counts on characteristics and types of solid waste collected, collection system, frequency of collection and availability of space to locate the containers. Ramat (2006) named several types of storage container that are used in Malaysia are:

a) Rolled On Rolled Off (RORO) Bin
b) Four Wheel Bin
c) Two Wheel Bin

d) Compost Bin

RORO type is widely used due to the storage capacity within the range 6 to 8 cubic meter (Ramat, 2006). This container is made from high yield steel to overcome physical handling and it is fully operated by mechanical power. RORO bin requires a simple operation, where the waste collection vehicle will lift up and land the container by using hook.

The container's location may depend on space availability and service-access conditions. While, public health mainly concerns about the invasion of storage of solid waste areas with pests and insects that potentially a disease vectors. While for aesthetic, it's engage to unsightly conditions of inadequate sanitary of containers and emission of odours.

2.2.3 Processing of Solid Waste

The purposes of solid waste processing are to downgrade the volume, regain usable materials or modify the physical form of the solid waste (Tchobanoglous et al., 1993). Food waste grinding, component separation, compaction, incineration (in fireplaces) and composting are the most common onsite processing operations.

Pichtel (2005) has quoted "composting is defined as a controlled aerobic, biological conversion of organic wastes into a complex, stable material". The outcome of final product is use for agricultural and landscaping purposes. Composting is an effective approach to reduce waste volume and shifting the physical composition by creating a new product for example product of organic compost.

2.3 Collection Of Solid Waste

2.3.1 Collection of Solid Waste

The collection concerns with residential and commercial refuse due to its large portion of sources. The key considerations as regard to collection are frequency of collection, point of collection, pickup density, programming and equipment (Diaz et al., 1993).

The frequency of waste collection is influenced by factors: volume of generation, fly production, rate generation's effect and cost (Davis and Cornwell, 2008). In hot and humid climates areas, the waste is collected more regularly as results of waste generation in larger volume in order to prevent fly production. Rate of generation also affecting frequency of collection since overloaded waste in the containers may cause nuisance or public health. Therefore it necessitates frequent collection and raises the cost of collection as well.

The position of the storage at the time of collection is refers to point of collection. The point of collection can be split into two extensive classes: backyard and curbside. Another factor influencing frequency of collection is pickup density. Pickup density denotes to the number of services per mile (Diaz et al., 1993). Increases in pickup density denote longer time per pickup.

One part of key consideration in waste collection is programming since it is engages with planning routes and control of manpower and equipment. The type of waste, disposal method, physical layout and climatic conditions are some of the factors need to be considered in programming (Diaz et al., 1993). Besides, equipment is also fundamental since collection vehicles should be covered and watertight to take into account of environmental and public health considerations.

2.3.2 Collection of Recyclable Wastes

Spencer (1994) states that "there are three main separation and collection approaches to recycling:

- Source separation by either the generator or the collector with consolidation for transport to the market..
- Commingled recyclables collection with processing at centralized materials recycling facilities (MRFs).
- Mixed municipal solid waste collections with processing for recovery of the recyclable material from the waste stream at mixed waste processing or front-end of processing facilities."

A high degree of homeowner participation is required by the source separation approach. This approach also entails high collection cost but low processing costs. On the other hand, commingled collection, demands the generator effort in an intermediate amount that add up collection costs and medium processing cost. While the third approaches did not call the generator for extra effort and cause no addition to collection costs but goes with high processing costs. Furthermore, there are some risk as regards to technology, operating costs and market economy (Spencer, 1994).

2.3.3 Collecting

The collection activities predominantly consist of gathering and picking up solid wastes from the point of solid waste generation, hauling the waste to the other location and unloading of the collection vehicle. The route of refuse collection system ought to consider of multiphase process as it cycle is from house to can, can to truck, truck from house to house, truck routing and truck to disposal (Vesilind et al., 2002).

The processes begin with property holder in conveying the waste to the refuse can or container which located indoor or outside the property. Residents are required to separate their wastes before collection. Secondly is the transfer of refuse can to the waste collection vehicle such as truck as the practice commonly done by the collecting workers. Otherwise the system is called curbside collection if the process ready by the property holder or by using conventional and specially designed collection vehicles.

Then, the refuse is compacted within the truck as it moves to accumulate waste from house to house. The next phase is the truck routing which must be well planned in order to achieve effectiveness collection route. Finally, the collection system involves the final destination of waste (materials recovery facility, transfer station or disposal site).

2.3.4 Collection Routes

The routing of collection vehicles within its assigned collection zone should be designed. The layout routes guidelines is to promote efficient network layout. Thus, minimize the numbers of turns and dead space encountered as well. Vesilind et al. (2002) cited the rules as:

- Existing policies and regulations associated to the point of collection and frequency of collection must be identified.
- Coordinated existing system characteristics such as crew size and vehicle types.
- Routes should be laid out so that they begin and end near arterials streets, using topographical and physical barriers as route boundaries wherever possible.
- Route should start at the top grade and proceed downhill as the vehicle becomes loaded in hilly area.
- Routes should be laid out so that the last container to be collected is located nearest to the disposal site.
- Wastes generates at traffic-congested locations possibly should be collected as early in the day.

- Services during the first part of the day for the sources at which extremely large quantities of wastes are generate.
- Services during one trip or on the same day, if possible, for scattered pickup points (where small quantities of solid waste are generated) that receive the same collection frequency should.

2.4 Disposal Of Solid Waste

The waste management structure is base up to the "3 Rs" which are reduce, reuse and recycle. It classifies the waste management policy according to their desirability in terms of waste minimization. Extracting the ultimate practical gains from products and generating minimum waste quantities are the top priority of the hierarchy. Figure 2.1 displays the waste management hierarchy.

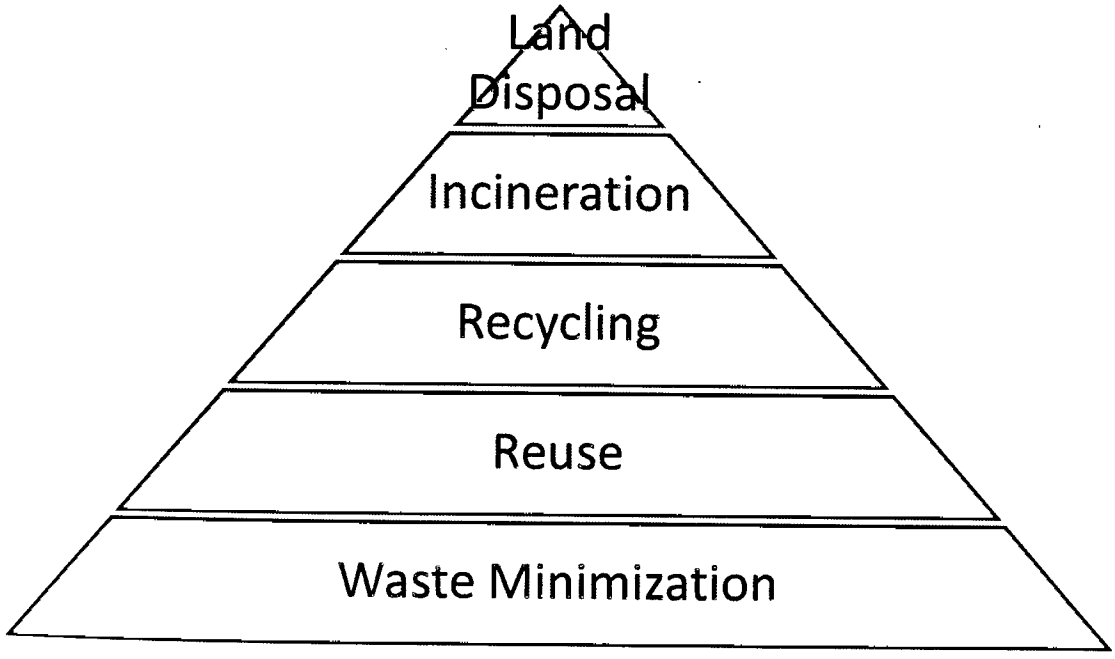

Figure 2.1 : Waste Management Hierarchy. (Source : Bagchi, 2004)

2.4.1 Recycling

Recycling terminology is defined as use of a material in a form of similar to its original (Pichtel, 2005). The process of recycling demands that the owner of the waste material first separate out the useful fraction so that it can be collected separately from others solid waste. Various components of municipal solid waste can be recycled for manufacturing and subsequent use, significantly paper, steel, aluminum, plastic, glass and yard waste (Tchobanoglous et al., 1993).

Today, there is no properly organized program for recycling in Malaysia. Stakeholders are now working on their own programs and objectives. Measures need to be taken to integrate the segregated efforts of the individual stakeholders into a single recycling program. The measures should be taken on both short-term and long-term perspectives. The aim for the short-term measures shall be to mobilize the stakeholders towards active recyclable generators and enhance their participation. Long-term measures should aim toward increased diversion of waste for recycling, an efficient recyclable collection system and an organized niche market.

A faith that public involvement in a recycling program will enhance recycling rate however the commonsense belief is not always endure in actual practice (Spencer, 1994). The extent of public participation is depends on several factors. Public education is a generous factor in view of the fact that participant with greater recycling knowledge will have positive outlook about the program. In addition, Spencer (1994) has stated both of recyclables and municipal solid waste collected in same day is significant to improve the public participation in to recycle.