



## A review of current status, challenges, and solution to improve waste management

Goh Zhu Hanga<sup>1</sup> and Tony Hadibarata<sup>1,\*</sup>

<sup>1</sup>*Environmental Engineering Program, Faculty of Engineering and Science, Curtin University, CDT 250, Miri, Sarawak, 98009, Malaysia*

### Abstract

Government plays the most important role in improving the waste management system. Incineration system can be introduced into the waste management system to incinerate specific type of waste. This will increase the availability space for the landfilling process. However, the incineration process must be carried out with full pollution control system to prevent and minimize the pollution that might cause during the incineration process. Other than that, the government should encourage the public to separate out the waste into different categories before the collection of the waste by the waste management company. This can be implemented by providing guideline for the separation of waste methods as well as encouraging the public to be responsible for own produced waste. The dumpsites must also be improved and it is suggested that all dumpsites used are engineered sanitary landfill. An engineered sanitary landfill will reduce the impact of the pollution towards the environment to the minimum. Better tools also must be included in the sanitary landfill system to monitor the condition of the landfill site. This will prevent the happen of any unexpected conditions and can be resolve before the happening of the unexpected condition. Last but not least, the government should implement new charging fee system for the waste management. The charging fee should be based on the rate of waste generated but not flat pricing. This will help in reducing the waste generated as all individuals must pay for their own generated waste. The earth belongs to everyone which indicates everyone have the responsible to keep the earth clean and to reduce the waste produce.

### Keywords :

Waste management, waste disposal, environmental health, sanitary landfill

## 1 Introduction

The human population has increase rapidly in past decades. This has brought several environmental issues towards our environment (HMGN, 2003). The increasing waste generation rate due to the increasing population is one of the major issues faced. This is a major current issue that the world is facing especially those countries that are in rapid developing stage (Seik, 1997). Urbanization and industrialization are the main reason that the developing countries contribute the most towards the increase of solid waste produced (Seik, 1997). The overwhelming waste produced has brought negative impacts toward our environment and are endangering the health of human being. According to research, about 0.49 billion tons of waste are generated in 1997 (Suocheng et al., 2001). It is estimated that the waste generation rate will increase about 4% every year in developed countries and about 3% in developing countries (Suocheng et al., 2001). The rapid development has also cause changes in the generated solid waste composition where the current methods use in the solid waste management systems are outdated and must be improve to adapt to the current waste management issues arise (Biswas et al., 2010).

Waste management is a process that manage the waste produce by human activities. The process starts when the waste is produced and end after the final disposal of the waste. The waste management will include the collection of the waste from all places, transporting the waste collected to site to gather all the waste collected, the waste collected will then be classified into different categories to undergo treatment and the final step is the disposal of waste into the landfilling site (Alagöz and Kocasooy, 2008). The rapid increase of human population has caused several issues regarding the waste management to arise. Those issues are commonly arisen in urbanization and industrialization areas which the waste management in those areas are still yet to be fully developed (Burnley, 2007). The low coverage and irregular collection service are one of the existing problems in the urbanization and industrialization areas waste management system. Other than that, the increasing waste generated by human activities have exceeded the limit where the waste can be manage by the waste management system that are designed (Alagöz and Kocasooy, 2008). This has caused the waste to be dispose through open burning and dumpsite without proper engineered technologies. There are several environmental issues that have arisen such as pollution of air and water, the increase of flies and vermin in the dumpsite and its surrounding (Manaf et al., 2009). The pollution of air and water are the most severe environmental impacts toward our environment. The air pollution from the open burning activities to dispose the waste without proper treatment and control have caused the quality of the air to drop in the region. Thus, the resident living in the area will faced serious health problem which

\* Corresponding Author.

Email Address : [hadibarata@curtin.edu.my](mailto:hadibarata@curtin.edu.my)

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the difficulties in breathing and lung cancer are the most common to be known. Other than that, the open dumping process without proper engineered technologies and tools have caused our water resources to be heavily impacted. Without proper engineered and technologies system open dumping, the leachate produced by the open dumping will runoff into the water resources nearby. It will cause the water resources to be polluted and will not be suitable for the use of human activities and consumption. There are many factors that restrained the waste management systems to be fully developed. Those factors are caused by the insufficient funds in developing the advanced waste management system, social development, outdated technologies and poor economic condition in the area (Manaf et al., 2009).

## 2 Waste management in Malaysia

Malaysia is a developing country in the South East Asia region. The population increase rate in Malaysia is about 2.4% per year (Kathirvale et al., 2004). The waste generated per person in Malaysia is estimated around 0.65 kg/person in urbanization areas and 1.7 kg/person in major developed cities (Kathirvale et al., 2004). It is estimated the waste generated by the Malaysian will increased to 31 thousand tons in the year 2020 (Kathirvale et al., 2004). The solid wastes that are generated by the Malaysian can mainly categorized into three different categories which are the municipal waste, hazardous and scheduled waste and clinical waste (Budhiarta et al., 2012). The waste management system in Malaysia is operated by privately owned company (Yunus and Kadir, 2003). However, the government of Malaysia still have the highest authority towards the waste management system as the privately owned company that runs the waste management system are supervise under the Malaysia Government (Yunus and Kadir, 2003). Most of the disposal of waste method used in Malaysia is open dumpsite without proper engineered or technologies to control the pollution that might cause the open dumping (Yunus and Kadir, 2003). There are only very few engineered sanitary landfill sites in Malaysia that provide full pollution control for the dumping of waste (Budhiarta et al., 2012) The open dumpsite without proper pollution control implement to dispose the waste has caused the arisen of several environmental issues.

**Table 1** Disposal sites in Malaysia (Manaf et al., 2009)

State	Openign dumping	Controlled dumping	Sanitary landfill	Total
Johor	12	14	1	27
Kedah	9	5	1	15
Kelantan	12	2	0	14
Melaka	2	3	0	5
Negeri Sembilan	8	6	0	14
Pahang	7	5	3	15
Perak	15	11	4	30
Perlis	0	1	0	1
Pulau Pinang	1	1	1	3
Selangor	5	15	0	20
Trengganu	2	8	1	11
Total	73	71	11	155

There are a total of 155 dumpsites in Malaysia with 3 different categories which are open dumpsites, controlled dumpsites and sanitary landfill, as seen in Table 1 (Manaf et al., 2009). Among the 155 dumpsites, only 11 dumpsites are sanitary landfill that have full pollution control towards all the possible pollution that might occur throughout the dumping process (Manaf et al., 2009). There are 73 open dumpsites in Malaysia without any pollution control

implemented. This is an alarming factor as among the 3 different dumpsites, open dumpsites without any pollution control have the most number in total. Open dumpsites without any pollution control will caused the most pollution towards our environment. Therefore, the health and living condition of the residents nearby the open dumpsites will be affected and will no longer suitable for human living. Other than that, the waste produced by Malaysian have also exceeded the estimated value and the landfills and dumpsites are being filled in a very fast pace where it will reach the limit faster than expected. Therefore, it is suggested that the Malaysian Government to take action in reversing the current situation of the waste management facing and to implement solution to help improve the current situation.

## 3 Challenges face by waste management

### 3.1 Rapid increase of waste production

The rapid increase in human population has caused the production of waste by human being to increase rapidly. The generation rate of waste that the human produced is faster than the current waste management system can hold (Hazra and Goel, 2009). This will caused the dumping site to reach full capacity of which the waste can be filled in a very fast pace. By so, more and more landfills and dumpsites will be requires to fit in the waste produce by the residents (Hazra and Goel, 2009). The main reasons behind the rapid increase of waste generated by human being in this era is caused by the consumerism habit of the people and the marketing strategies of producer to reach maximum profit for their companies (Henry et al., 2006). Most of the consumer will choose to purchase lower cost one time use products instead of long last product (Henry et al., 2006). For example, consumer will choose to purchase one time use cotton ear bud instead of washable steal ear bud. On the other hand, the producer will want to maximize their profit from the product by producing one time use products (Henry et al., 2006). In addition, most of the materials used to produce the products are not reusable or recyclable which the ultimate of the faith will end up in the dumpsite (Henry et al., 2006). In this modern era where networking is very developed and the user can purchase anything online with highly efficient delivering speed. This is a very serious issues as more and more waste will be generated where more space are requires to dispose those waste.

### 3.2 Toxic waste produced

The rapid development in industrial sector has caused most of the waste produced to be chemical substances which is toxic (Hui et al., 2006). Those chemical substances cannot be disposed into the landfilling without special treatment. The handling of toxic chemical substances requires more caution throughout the waste management process (Hui et al., 2006). The chemical substances must be properly stored before treatment and special dumpsite are require to dispose those chemical waste. This will increase the difficulty for the waste management to dispose the chemical waste as it requires special handling method (Hui et al., 2006). Other than that, plastic is the most challenging waste to be dispose that are produce by the human being. The use of plastic is very common and can be seen all around the world (Suocheng et al., 2001). It is estimated of all waste, 40% is compose by plastic (Suocheng et al., 2001). Plastic is a non-biodegradable waste which will take a very long time to be degraded. The overwhelming plastic produce has not only polluted the land but the ocean is also heavily impacted. The packaging used in food industry is also a growing issue for toxic waste produced. Most of the packaging used in food industry is made up from plastic which are poorly regulated (Xiao et al., 2007). The material used to produce the food packaging is also

not environmentally friendly material that can be degraded once used. Therefore, it is a rising issues as the used of plastic and toxic chemicals in human daily life is increasing the level of difficulties for the waste to be manage and dispose.

### **3.3 Landfills challenges**

Landfill is the ultimate faith of all waste that cannot be recycle or reuse. Among all of the waste produce by human being, only a small percentage of waste will be recycled or reused (Alavi Moghadam et al., 2009). This has caused the dumpsites to be overwhelm with waste produce by human being. Therefore, the landfills or dumpsites play an important role to maintain the level waste produce to be not all around the country as this will ruin the image of the cities and countries. However, most of the dumpsites that are currently used to dispose the waste produce by human being are not equip or design with pollution control technologies and methods (Minghua et al., 2009). This has caused the leachate that the waste produce to runoff into the nearby water resources creating enormous impact towards the environment. The purpose of landfill is to protect and minimize the environment from pollution (Wang et al., 2008). Thus, the use of open dumpsite as landfill has not met the purpose of the design of landfill and are creating serious damage towards our environment. Other than that, special types of landfill must be designed and used to dispose clinical waste, chemical and hazardous waste.

### **3.4 Separation of waste and recycling**

Separation of waste is a big challenges face by the waste management company. Effective waste separation method use by the public before the collection of waste from the management company can greatly help reduce the waste collected for landfilling purpose (Huang et al., 2006). It is caused that all of the waste produced are not always disposed in the dumpsite. Those recyclable material will be recycled and used in for other purpose. However, the separation process is heavily depending on the waste management company (Zhuang et al., 2008). This is because most of the resident will not separate out the recyclable materials from the waste. The separation process will only take place through scavenging in the disposal process of the waste by the waste management company (Zhuang et al., 2008). The rate of the recovered waste that are recyclable will reduce as the recover process that take places at the site is not as efficient as the separation of waste that take places at the first place (Chung and Poon, 2001). This is because that when all of the waste is collected and gathered up, it is very difficult to differentiate and recovered those that are recyclable from the waste. Moreover, the paying rate for those recycled waste is not attractive enough to encourage the public to be involve in the private recycle sector (Chung and Poon, 2001). In addition, the lack of reused materials process market is also one of the reasons that the pay of for recycle materials to be low.

## **4 Solution towards waste management**

### **4.1 Incineration process for the waste management**

Incineration process is part of the waste management strategy to burn off specific type of waste to produce heat energy (Liu et al., 2006). The incineration will not cause major air pollution towards the environment as the process is closely control and the air will be treated before releasing to the environment (Liu et al., 2006). This will save up a lot of spaces for the dumpsites to be filled with other wastes that are not suitable for incineration process (Shekdar, 2009). The byproduct of the incineration process which is the

bottom ash that produce after the process can be used for construction purposes. However, the bottom ash residue of the incineration process must go through several stages of treatment to remove the hazardous pollutant before allowing the byproduct to be used as the construction materials. In addition, the high heat produce throughout the incineration process can be used to generate electricity. The generate electricity can save up some cost to further improve the facility inside the waste management site and to adopt more advanced technologies to lower the pollution cause throughout the waste management activities. Therefore, it is suggested that the waste management company to adopt the incineration process with high advanced technologies to reduce the pollution cause by the incineration process to its minimum. This will help to save up more space to allow the landfill to be filled with other wastes that are not able to be incinerate.

### **4.2 Improving the separation and recycling of waste process**

The best way to reduce the waste being landfill in the dumpsite is to recycle the waste that are able to be recycle (Li, 2002). The government should enforce rules and regulations to improve the current separation status by the public. The enforcement of strict rules will encourage the public to separate the waste to different categories (Tinmaz and Demir, 2006). This will increase the efficiency of the waste management by maximizing the desired outcome for reducing the waste. Other than that, the government should give out guideline regarding the recycling program. This will help the public to understand more regarding the recycling program and to differentiate between recyclable materials and non-recyclables materials (Tinmaz and Demir, 2006). In addition, the government can send representative to each household areas to give campaign and talk regarding the importance of separating the waste. This will inspire more public to join in the program to help protect our environment from further pollution. Moreover, the separated waste before landfilling will also increase the efficiency of the waste management (Yang et al., 2015). This is because the separated high moisture content waste will help decrease the leachate during the landfill process and also will improve the incineration process with lower net caloric values. The government should also set up more recycle center to let the public to be more convenience in the recycling of the waste.

### **4.3 Implement better landfill design and technologies**

Landfilling is one of the most crucial parts in disposing of the waste generated. The landfilling should include biological pre-treatment of the waste before disposing (Mrayyan and Hamdi, 2006). This will help in increasing the efficiency of the waste management outcome. With the implement of biological pre-treatment into the landfilling process, the time taken for monitoring period can be greatly shorten, the quality of the leachate that are produced during the landfilling process will requires less treatment before the leachate can be transform into usable water resource and the landfilling can saved up more space for more waste to be dispose as the biological pre-treatment will have better compacted waste for the landfilling (Matete and Trois, 2008). This will help the waste management to be more environmentally friendly and the landfill can adapt more waste and last longer. Other than that, the landfilling process should include technologies to monitor the chemical substances, pollution level and leachate condition inside the landfill. This can help the waste management company to take quick response and action towards unpredictable condition from happening (Matell and Jacoby, 1971). Thus, protecting the environment from pollution and resolve the unexpected condition in early stages before the condition become critical towards the environment. Therefore, the government should

fund more into the development of better landfill design and technologies to help improve the efficiency of the waste management. This will also help to better protecting our environment.

#### 4.4 Implementing new waste charging fee system

The government should implement a better fee charging system for the waste management service. The better fee charging system can accumulate more funds to conduct more research to develop better waste management system and technologies (Bai Sutanto, 2002). The implement charging fee system should be based on the rate of the waste generated instead of one flat rate where everyone pays the same price. This will encourage the public to reduce the waste produce as the charges for waste management are based on the volume of waste produced by each individual (Chung and Lo, 2008). However, the government should prepare a guideline for the public to understand how the new charging fee system works. Representative from the government can also conduct campaign and talk to inspire more people to understand how the system works and encourage them reduce the waste produce by using long-term materials made product instead of one-time used product (Cheng et al., 2007). In addition, the government can also implement a new policy where the public will get be rewarded when the waste produce by them is at a certain low level (Qdais et al., 1997). This will further encourage the public to reduce the waste produce and to take initiative to protect our environment from overwhelming waste produce. Therefore, the government plays an important part to develop a new charging fee system for the waste management service (Dennison et al., 1996). The new fees implemented must be reasonable and cannot be overpriced as this might cause the happen of some unwanted condition such as the disposing of waste illegally.

## 5 Conclusions

In conclusion, the rapid development of urbanization and industrialization have caused severe waste management issues to arise. The rapid growth of human population has caused more waste to be generated. This has caused the waste generated exceeding the limit that the waste can be manage. Other than that, the mentality of consumer and producer to maximize the profit has caused more waste to be generated. In addition, the wastes that generated are toxic and hazardous which have cause severe problems to the environment. Among all of the waste generated, plastic is the one that caused most impact to the environment and the waste management system as it is non-biodegradable. Substitution materials and source reduction need to be implemented to replace the use of plastic. Moreover, the current dumpsites are not effective in the waste management system as most of the dumpsites are open dumping sites without any pollution control towards the environmental issues. The use of open dumpsites as landfill without any pollution control will expose the waste into the environment causing several environmental issues such as the leaching of leachate causing water resources pollution, air pollution cause by the smell of the waste and disease outbreak. The separation of the wastes is also one of the challenges faces by the waste management system. The waste should be separate into different categories such as recyclable and non-recyclable to ease the process of waste management and improve the efficiency of the waste management system.

## Declaration of competing interest

The authors declare no known competing interests that could have influenced the work reported in this paper.

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