

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

Every year, the level of waste generation continues to rise because of uncontrolled consumption due to increasing population, attitudes towards spending and high living standards. Quantities of waste generated are growing in response to the rapid increase in population, accelerated urbanisation and industrialisation. However, with the increasing population, the volume of waste generated remains abundant. Solid waste is generated from various domestic (schools, hospitals, universities, offices) and commercial (from restaurants, hotels, markets and industry) sources and consists of biodegradable matter, as well as inert non-biodegradable matter. The most dominant variable in the municipal solid waste (MSW) flow is food waste. Relatively homogeneous residential waste, some differences in the waste depends on local factors and other demographics; most households dispose of the same type of waste (Yousuf and Rahman, 2007). Trends in the composition of MSW in Malaysia showed that food, paper and plastic are the main components of waste generated in most places (Agamuthu et al., 2007). The main household waste composition includes 71% organic waste, 12% plastic, 7.5% paper and paper products, 5% dirt and construction debris and 1% hazardous waste. The highest percentage is organic waste, although the composition of the waste varies depending on the source.

The handling and separation of wastes at the source is a critical step in waste management in Malaysia. Solid waste management can be defined as a discipline related to the control of waste generated. The storage of waste used various types of bins such as a small bin for household, medium and large bin for industry or

manufacture. The most used bins for residential areas are small bins. Also, the bins used are made of various materials, such as plastic, metal, rubber, mixed paper, and cardboard boxes. In the case of high-rise building, communal bins or central container is used. Waste collection activities are the most expensive activity in waste management systems. The introduction of intermediate treatment facilities such as transfer stations, composting and incinerator plants, may become the alternative treatment of waste in Malaysia. The government is also considering the various designs and modes of incineration process available in the market. One of the process is the thermal gasification process (Earth Observation Centre, 2011).

Jabor Landfill is the only landfill in Kuantan, which is located in Pahang Service Area 1 (PSA1) covering the district of Kuantan in the state of Pahang. It is approximately 300 km away from Kuala Lumpur and 25 km from the city of Kuantan. The total site area is 30 hectares. There is also a system of leachate containment, leachate collection system, leachate treatment plant and landfill gas management (Alam flora, 2006). Approximately 500 tons of waste are collected at Jabor landfills every day, using the concept of semi aerobic recirculatory system treatment or Fukuoka methods as a solid waste management.

Leachate production is one of the biggest problems associated with the operation of environmental sanitary landfill, because the liquid waste can cause harmful pollution problems by contaminating surfaces and ground water as well as surrounding soil surfaces. *Clostridium perfringens* and fungal filaments are usually contaminated leachate. In addition, there are bacteria, which includes aerobic, coliform and fecal coliform, psychrophilic and mesophilic bacteria, and spore-forming bacteria (Matejczyk et al., 2011). The two bacterial groups that showed a good adaptation and critical participation in the leachate treatment for almost the entire duration of treatment are *Actinomycetes* and *Bacillus* (Yahmed et al., 2009). Analysis of individual substrate utilisation patterns of bacteria isolated from the leachate collected at successive sampling dates showed a decrease in the percentage of Gram-negative bacteria, which are able to metabolize sugar selected by increasing the percentage of Gram-positive bacteria that are capable of metabolizing sugar (Hale Boothe et al., 2001). Therefore, one of the objective in this study is to identify and to compare the number of species of

bacteria that live in landfill soil and leachate, which have the potential to produce amylase, protease, cellulase and lipase enzymes. The bacteria could be the agent of biodegrader for municipal solid waste treatment. With that abundant amount, it needs various efforts to reduce the high production of waste. Sanitary landfills and incinerators cause further effects that are more harmful to living beings and environment. Biodegradation is one of the waste managements that can produce a product that are beneficial to plants. It can convert up to 50-60% of the waste into biofertilizer. The product will be richer in microbes, thus can improve plant nutrient uptake, which is also effective in increasing agricultural production.

Biodegradation process involves biological and chemical processes. The enzyme activity is affected by the type of substrate, temperature and microbiological activity to degrade waste. Monitoring enzyme activity during the composting process can provide valuable information related to the dynamics of essential nutrients such as C, N or P, and contribute to developing a better understanding of the transformation that occurs during composting (Vargas-García et al., 2010). Microorganism-induced degradation of organic materials depends on the activity of various hydrolytic enzymes (Raut et al., 2008). Each material source will demonstrate different enzyme activities. The rate of decomposition is highly dependent on the quality of the organic substrate, environmental conditions, the chemical nature of the substrate, and the activity of microorganisms (Jurado et al., 2014).

1.2 PROBLEM STATEMENT

To identify the trend of the various types of waste that goes into landfills each year, it is necessary to conduct waste classification update. This is useful to determine what management will be implemented to resolve the problem of municipal solid waste in Kuantan. Food is the majority biodegradable component of municipal solid waste, which consists of more than 50%. Municipal solid waste management costs are expensive and require other alternative management for example incineration, sanitary landfill and their technologies. Composting is one of solid waste management that is economical, convenient and can produce useful organic fertiliser for crops. However, Jabor landfill never applied this treatment as a combination for the waste treatment.