Solid Waste Impact on the Use of Natural Resources

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Abstract. Among other types of waste, municipal solid waste is commonly encountered and rapidly generated since it includes everyday items that are discarded by the public mainly household and commercial sectors. Increasing number of population has made it worst since it contributes further to the generation of more and more waste. In areas where recycling activities are not the norm of the society, the municipal solid waste will consist of numerous types of waste which are dumped together yet it cannot be destroyed in one similar way. Open dumping, open burning as well as landfills are among the unsustainable techniques commonly practices in Malaysia. Improper waste management system creates environmental impacts which are irreversible most of the time. This conceptual paper aims to highlight the significant impacts of the solid waste management to the use of natural resources and to suggest alternative waste management system that would minimize environmental impacts. It is hoped that the outcome of this paper could create greater environmental awareness of the society that would entice environmental friendly behavior leading to sustainable waste management system.

Introduction

Managing solid waste has becoming a major and serious issue that kept on piling up worldwide. Commonly, it is considered as among the top five most challenging problems by city managers (United Nations Human Settlements Programme (UNHABITAT), 2010). Economic development leading to rising living standards, rapid industrialisation and urbanisation have up surged the waste generated (Samsudin & Don, 2013). For over a 10-years period (1996 to 2006) municipal solid waste (MSW) generated in Malaysia has increased more than 91% due to rapid development of urban areas (Samsudin & Don, 2013). 37,000 tonnes of waste generated daily by Malaysian which amounted to 13.5 million tonnes of waste generated every year. The amount is equivalent to a size of an area filled with 30,000 aeroplanes-Airbus A380 and the country spent RM2.2 billion to manage that amount of waste (Utusan Online, 2017). Undeniable this issue needs everybody living in this one earth to pay serious attention before it is too late.

However, according to Samsudin and Don (2013) education has a big influence on human respond and cooperation on waste management issue. Inadequate knowledge on environmental matters such as environmental impacts, would add up to the low level of environmental awareness among the general public. Efficient waste management system implemented by any country could still end up as failure if their citizens are environmental ignorance and unable to fulfil their duties to manage the waste from the source.

In an attempt to create environmental awareness among the general public in Malaysia, this conceptual paper aims to highlight the significant impacts of the solid waste management to the use of natural resources and to suggest alternative waste management system that would minimize environmental impacts. It is hoped that the outcome of this paper could create greater environmental awareness of the society that would entice environmental friendly behavior leading to sustainable waste management system.

Categories of Waste

Waste is unavoidable by-product of most human activities. It is unwanted, worthless, defective or unusable substance discarded after primary use. It can be categorised into municipal solid waste, industrial solid waste, agricultural waste and hazardous waste. Municipal solid waste (MSW) is generated from households, offices, hotels, shops, schools and other institutions whereas industrial solid waste encompasses a wide range of materials of varying environmental toxicity.
According to Anonymous (2005) solid waste refers to all non-liquid wastes and these solid wastes can be divided into several categories:

Table 1: Category of Solid Waste

CATEGORY	EXAMPLES
Organic waste	waste from preparation of food, market place etc
Combustibles	paper, wood, dried leaves, packaging for relief items etc
Non-combustibles	metal, tin cans, bottles, stones etc
Ashes/dust	Residue from fires used for cooking
Bulky waste	tree branches, tyres etc
Dead animals	Carcasses of domestic animals and livestock
Hazardous waste	oil, battery acid, medical waste
Construction waste	roofing, rubbles, broken concrete etc

Municipal Solid Waste (MSW)

With an initiative plan under 'Transformasi Nasional 2050' (TN50) for Malaysia to become a 'top 20 nation in economic development, social advancement and innovation', municipal solid waste (MSW) management is not an issue to be left behind in the developing process. Being the type of waste generated from households, offices, hotels, shops, schools and other institutions rapid industrialisation and urbanisation will bring along environmental problems if MSW is not managed accordingly.

According to Abila (2014) and Samsudin and Don (2013) in Malaysia, 80% of the MSW comprise of foods, papers and plastics. Abila (2014) categorised MSW into two broad categories namely organic which include food wastes, wood/ leaves, paper, plastics, textile/rubber/leather and 'undefined miscellaneous organic and inorganic which includes glass and metal. Organic category is further divided into easily biodegradable wastes components which include food waste and non-easily biodegradable which include papers, cardboards and tetra packs.

The composition of waste (percentage of wet weight) in Malaysia for 1975-2005 is provided in Table 2 below.

Table 2: The composition of waste (percentage of wet weight) in Malaysia for 1975-2005.

	1975	1980	1985	1990	1995	2000	2005
Food	63.7	54.4	48.3	48.4	45.7	43.2	44.8
Paper	7.0	8.0	23.6	8.9	9.0	23.7	16.0
Plastic	2.5	0.4	9.4	3.0	3.9	11.2	15.0
Glass	2.5	0.4	4.0	3.0	3.9	3.2	3.0
Metal	6.4	2.2	5.9	4.6	5.1	4.2	3.3
Textiles	1.3	2.2	NA	NA	2.1	1.5	2.8
Wood	6.5	1.8	NA	NA	NA	0.7	6.7
Others	0.9	0.3	8.8	32.1	4.3	12.3	8.4

It was notified that 17,700 tonnes of food waste was produced by Malaysian on daily basis (Anonymous, 2017). During the fasting month Ramadhan, it was identified by Solid Waste Corporation (SWCorp) that each year the Malaysian citizens had wasted away 270,000 tonnes of food and most of the food was thrown away before it is being actually consumed. Knowing the major components of the MSW would allow the choice of disposal methods that should be effective to minimise the environmental impacts of MSW.

Disposal Methods of MSW

Various disposal methods of MSW are available which include open dumping, landfilling, composting and incineration. Despite the serious threat to groundwater resources and soil Ali, Pervaiz, Afzal, Hamid and Yasmin (2014) state that open dumpsites are still considered as a common practice by most developing countries due to its low cost implication. Daily MSW generation in Peninsular Malaysia is more than 19000 tonnes where approximately 75% of this waste is collected and disposed in 130 landfills and dumps (Periathamby, Hamid, & Khidzir, 2009). Accordingly Sakawi (2011) and Samsudin and Don (2013) reported that disposal of waste in Malaysia is totally landfill which commonly referred to open dumping and landfilling.

Consequently, the disposal methods for MSW in Malaysia concentrated on open dumping (50%) and landfilling (35%). Meanwhile only 10% utilized composting method and 5% incineration (Anonymous, 2015). The percentage of waste treatment methods applied in Malaysia is shown in Table 3.

Table 3: The percentage of waste treatment methods applied in Malaysia

Treatment Methods	**Percentage (%)**		
	2002	**2006**	**2020**
Recycling	5.0	5.5	22.0
Composting	0.0	1.0	8.0
Incineration	0.0	0.0	16.8
Inert landfill	0.0	3.2	9.1
Sanitary landfill	5.0	30.9	44.1
Other disposal sites	90.0	59.4	0.0

Even though, composting and incineration could produce valuable by-products such as fertilizer from composting and renewable energy from incineration, they are not considered as popular disposal methods because intensive management and experienced personnel are required for large-scale operations (Anonymous, 2015). Composting involves decomposition of organic waste by allowing the waste to stay accumulated in a pit for a long period of time (Compactor Management Company, 2018) to allow for the microbial activity (Anonymous, 2005). Unfortunately, lack of material segregation from the source caused the organic waste to be dumped together with plastic, glasses or toxic residues and it would add further challenge to the process. Moreover, contaminated compost is no longer suitable and safe for agriculture application (Anonymous, 2015).

On the other hand, despite the potential renewable energy derived from incineration it remains as expensive and technically inappropriate waste disposal solution for most countries in Asian and Pacific Region (Anonymous, 2015). According to Wikipedia (n.d) incineration is 'a waste treatment process that involves the combustion of organic substances contained in waste materials into ash, flue gas and heat". It is often suitable for the disposal of combustible waste in which the waste would be ignited within waste incineration facilities to reduce the volume of waste. Yet, the need to develop the incineration facilities which require higher capital, operating and maintenance cost as well as strict air pollution control impeded this method to be selected for solid waste management system.

May be due to the above reasons landfill is the popular option of MSW management system in all the states in Malaysia. However, most of the landfill sites are open dumping (Anonymous, 2015) and landfilling is becoming more and more difficult due to land scarcity. A landfill site is a site for disposal of waste materials either by burial or just left in piles. Whereas, landfilling referred to waste treatment where the waste is placed in a large pit in the ground and the pit will be covered with the excavated soil each day the waste is tipped. Land scarcity coupled with extreme amount of waste collected for disposal creates difficulty for landfilling process to be implemented. Then, the MSW would have been dumped openly while waiting for proper waste management. Unbearably, such procedure would create greater problems which would affect the environment as well as living creature either human or animals living in the nearby area.

However, landfills are commonly utilized for handling MSW in urban areas and cover about 66% of the population in the rural area (Samsudin & Don, 2013). Consequently, in rural areas waste are being dumped on the streets, drains and rivers

Solid Waste Management and Its Impact to the Environment

The one Earth that every human and all other species are living in contains among the important natural resources namely water, air and land which support the basic needs of living things (Nik Wan, 2017) Global warming, the destruction of the ozone layer, air, water and noise pollutions, land degradation, water crisis, extinction of animals and many more are among the environmental impacts experienced worldwide. The choice of solid waste management would somehow contribute to the above environmental impacts.

Land Degradation. Most of the disposal sites in Malaysia have been overloaded. Accordingly, landfills have a distinctive effect on air pollution, nature, land and humans. Undeniable the disposal sites' lands have been degraded in value with possible contamination of chemicals and hazardous substances. With piles of non-biodegradable solid waste prevent the

waste to be decomposed naturally and it will remain in the landfills for years. Excessive and uncontrollable increased amount of wastes require more land to be sacrificed as landfills. Contaminated land is no longer usable for agriculture and may no longer be safe to be transformed to housing area .According to [conserve] the toxic chemicals would destroy the quality of soil and consequently upsetting the land ecosystems. Meanwhile heavy metal that contaminated the land can also negatively affect human health, animals and soil productivity. (Smith et al., 1996). It can no longer suitable for agriculture and any growth of plants will be retarded (Moustakas et al., 1994) since the metal content has jeopardized the nutrition of the land (Shaylor et al., 2009).

Water Pollution. During rainfall, dumped solid waste at the landfill sites will contain with water that will carry its by-products of decomposition into the water through the waste deposition. The liquid comprising innumerable organic and inorganic compounds is called 'leachate'(Nagarajan, Thirumalaisamy, & Lakshumanan, 2012). There is higher possibility for the areas near landfills to experienced contamination of groundwater. Leachate transports high concentrations of physicochemical parameters including heavy metals which can deteriorate the quality of the groundwater for drinking and other domestic purposes.

On the other hand, there are also people who take the easier way by illegally dumping their waste mostly solid waste the rivers nearby their locality. In 2006, it was reported that Malaysian Federal Government had approved RM903 million to clean three rivers in Johor Bharu (News Strait Times, 2006a) and Malaysian Government could end up spending RM2 billion to clean each river if it continues to be polluted (News Strait Times, 2006b). Less and less rivers are available for domestic use. Not only the water was polluted and is not safe for human activities but it would also affect living creature that live in the rivers as well as those animals that are relying on the rivers for the food supplies.

Air Pollution. Disposal of waste through landfills and open dumping could lead to illegal activities of open burning which would pollute the air. Despite the smoke caused by the burning process, unpleasant odour, dust and unhealthy particle would be released to the air as well. The nearby communities even though they are considered as to be minorities, the danger of them directly exposed to chemicals through inhalation of landfill gas (LFG) cannot be ignored (Palmiotto et al., 2014). The LFG gas emission mostly contain of methane, carbon dioxide, water vapour and trace amount on non-methane organic compounds (Palmiotto et al., 2014) notify that exposure to unpleasant odors for a continuous period of time.

Environmental Friendly Initiatives

Recycle, reduce and reuse are three environmental friendly initiatives that could protect the adverse impact on the natural resources. Municipal solid waste need to be reduced from the source rather than managing it at the dumpsites. Non-biodegradable plastics packaging for example, should be reduced and replaced with biodegradable materials. Even though individual effort seems to be having minimal contribution to saving the environment importantly the natural resources, but collectively it would give significant impacts in reducing the production of waste.

Conclusion

Waste management is not a new issue that have been discuss globally. Despite knowing its adverse impact on the environmental not many countries seems to see this problem as a serious matter. Land degradation, water pollution and air pollution are among the impacts faced by the regulators in many countries. However, regulators should not be the only party responsible towards waste management. Individuals who are considered as the main contributors to the piling up of the waste should also be equally liable for their actions. Waste should be prevent from being created in the first place.

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