

HOUSEHOLD HAZARDOUS WASTE COMPONENTS IN MALAYSIAN MSW- THE CURRENT SCENARIO

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SUMMARY: The largest household hazardous waste (HHW) contributor was the middle-income group (US\$500-\$1000) at 2.03% followed by the high-income group that earns more than US\$1000 (1.8%) and low-income group earning less than US\$500 (1.46%). Weight-wise, the biggest generator among the three levels of households is the high-income group contributing approximately 130 kg per day of hazardous components in the MSW stream. On averaged, landfills in Malaysia received 1.26% of HHW in the waste stream daily which works out to approximately 290 tonnes per day. Improper disposal of these waste resulted with detrimental environmental pollution that calls for urgent needs of improvement. Among the recommendations identified to improve the current scenario are the implementation of appropriate policy, increasing environmental consciousness among the public and improvement in the collection and disposal option for HHW as being practiced by many developed countries. This will improve the livelihood of the public with a safer living environment in Malaysia.

1. INTRODUCTION

Municipal Solid Waste (MSW) in Malaysia is generally a heterogenous combination of various waste including putrescible waste, paper, plastic and others (Agamuthu *et al.*, 2005; Fauziah *et al.*, 2004) together with a considerable percentage of hazardous components. HHW can be defined as waste which contained components like paints, batteries, pesticides and many more. The Environmental Quality (Scheduled Wastes) 1989 defines hazardous waste as any waste falling within the categories of waste listed in the First Schedule or any waste having dangerous characteristics according to the national standard. The most commonly found hazardous waste in MSW ranged from soaps and cleaners to expired drugs and pesticides (Zand and Abduli, 2007; Schwarzbauer *et al.*, 2002, Slack *et al.*, 2005). The 3% annual increase in waste generation pose greater risk to the environment due to the contamination of hazardous compounds originated from its disposal at MSW landfill. The issue of hazardous component in MSW is very crucial and need prompt action to prevent environmental contamination and pose potential danger to human. This study intends to determine the quantity of hazardous waste disposed into the MSW stream by different social group namely the high-income group, middle-income group and low-income group and quantifies the amount of hazardous waste in MSW received by landfills of different urbanization including the urban, sub-urban and rural landfills.

2. MATERIALS AND METHODS

2.1 Hazardous waste components received by landfills

Studies involved three landfills selected from rural, sub-urban and urban areas. A quarter loads from randomly selected garbage trucks were segregated to determine the quantity of the hazardous waste component present. Types of hazardous waste were identified to determine the possible sources of origin in order to formulate the appropriate scheme to reduce its generation in the waste stream.

3. RESULTS AND DISCUSSION

3.1 Quantification of Hazardous waste from households

From the studies, it was found that different income groups generate different quantity of waste everyday. The findings were agreeable with previous studies where middle income group generates the lowest amount of waste as compared to that of the high income and low income groups (Agamuthu *et al.*, 2005 and Fauziah *et al.*, 2004). The high income groups generate larger amount of MSW because of their affordability to consume more ready-made goods. On the other hand, the low income was also generating high amount of MSW as this group tends to process their own goods which in the course produce by-products and wastes. With regards to HHW from the three income groups, the generation averaged at 1.76%. Table 1 indicates the percentages generated by the household from different income level.

Table 1- Generation of MSW and hazardous waste in household.

Generation per household	High income	Middle income	Low income
MSW	7.02kg	3.51kg	5.94kg
Hazardous waste	1.8%	2.03%	1.46%

Even though middle income group generates the least amount of MSW, the presence of hazardous component accounted up to 2% or 0.07 kg per household. The high income and low income were found to generate approximately 0.13 kg and 0.09 kg, respectively, which actually was relatively higher than the generation by the middle income group. Even though the difference in the amount of household waste generated by different income group was not significant, the production of 0.07 kg from each middle income household influence the quantum of hazardous components as this group covered more than 50% of approximately 25 million populations in the country.

3.2 Socio-economic influences

From the data obtained (Table 1), the middle income group generated the highest percentage (2%) of hazardous component in their waste as compared to other income groups (1.4-1.8%). The main factor is the power of purchasing goods where consumers from middle income group have the ability to purchase products which is of a better quality but less environmental-friendly. Surveys indicated that people from the middle class generally is not willing to pay extra for environmental-friendly products (Irra, 1999). Therefore, the possibility for them to utilize goods which contained hazardous compound of slightly lower prices is higher. Other contributing

factors include lack of awareness on hazardous waste issues and the inefficient waste collection systems (Agamuthu, 2001).

The low generation of HHW by the low income group is probably due to the lack of knowledge on HHW disposal. Assuming all garbage are the same, this group would end up throwing all types of waste including HHW into their MSW stream. The high income group contributed a slightly higher percentage of HHW than that of the low income group. This group can afford to purchase more goods due to their socio-economic life-style. They tend to consume more luxurious goods for their comfort even though the goods are non-environmental friendly such as hair spray, aerosol disinfectant and others. This trend is expected to continue with the country's GDP growth rate at 5.7% for the first quarter in 2005. With the current Malaysian consumer price index at 2.6, the socio-economic aspect strongly influences in the generation of HHW. This is basically reflected in their life-style.

3.3 Hazardous waste component received by landfills

The volume of waste received by each landfill in the country differs with the location of the landfill and the areas serviced by the landfill. The urban landfills receive approximately 300 to 500 tonnes of waste daily, while the sub-urban and rural each received 100 to 200 tonnes and 50 to 70 tonnes, respectively (Fauziah *et al.*, 2004). Figure 1 indicated the average percentage of various waste groups received by landfills in Malaysia.

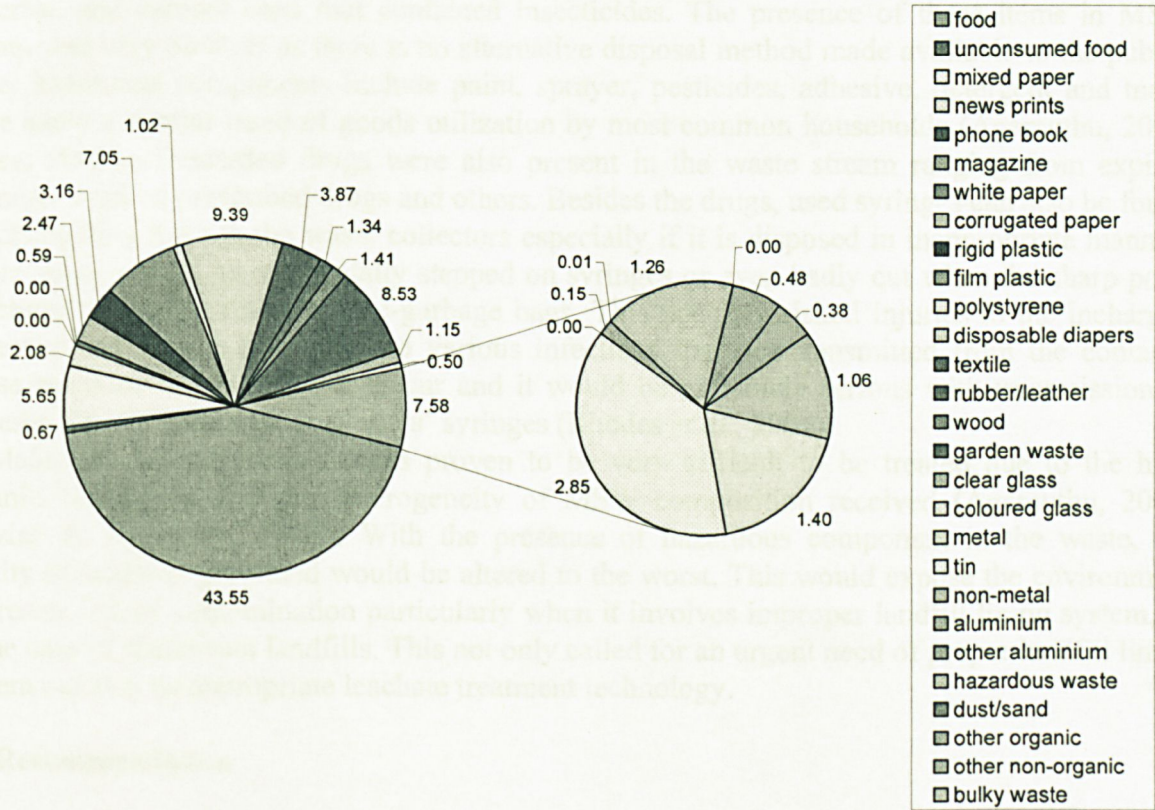


Figure 1. Average percentage of various waste types received by landfills in Malaysia.

Results from the studies indicated that on average approximately 227 tonnes of HHW were received daily by the landfills contributing 1.3% of the total waste generated by the country. The tonnage of waste received by landfills relates to the level of the landfill where urban landfills received as nearly 7-10 times more waste than that by the rural landfills. Therefore, the amount

of hazardous component in the waste stream increases with the level of landfill from the rural to sub-urban and urbans. Table 2 indicates the amount of non-industrial hazardous waste received by landfill through the MSW stream.

Table 2- Average tonnage of household hazardous component received daily by landfill of different types.

Type of landfill	Average quantity of hazardous component in MSW stream daily
Urban landfill	4.76 tonnes
Sub-urban landfill	2.67 tonnes
Rural landfill	0.854 tonnes

The difference in the amount of hazardous component received by the three landfill types were found to be statistically significant with $p= 0.00284$ through an ANOVA test. Therefore, it can be conclude that different level of landfill will give a significant difference in the amount of HHW received everyday.

3.4 Sources of contamination

The main components in the household hazardous waste found in Malaysian landfills are batteries, and aerosol cans that contained insecticides. The presence of these items in MSW stream was very obvious as there is no alternative disposal method made available to the public. Other hazardous components include paint, sprayer, pesticides, adhesive, detergent and many more show a similar trend of goods utilization by most common households (Agamuthu, 2001; Gatke, 2003). Discarded drugs were also present in the waste stream ranging from expired vitamins, expired prescribed drugs and others. Besides the drugs, used syringes can also be found which creating risks to the waste collectors especially if it is disposed in inappropriate manners where waste collectors accidentally stepped on syringes or even badly cut when the sharp point punctured the conventional house-garbage bags. This not only risked injuries to the incharged collectors but also expose them to various infectious diseases transmitted from the contacts. These accidents are possible to occur and it would be extremely serious with transmission of diseases like HIV through drug-users' syringes (Rhodes *et al.*, 2005).

Malaysian landfill leachate was proven to be very difficult to be treated due to the high organic component and the heterogeneity of MSW composition received (Agamuthu, 2001, Fauziah & Agamuthu, 2005). With the presence of hazardous component in the waste, the quality of leachate generated would be altered to the worst. This would expose the environment to greater risk of contamination particularly when it involves improper landfill lining system, as in the case of Malaysian landfills. This not only called for an urgent need of proper landfill lining system but also an appropriate leachate treatment technology.

3.5 Recommendation

As the country lacked the legal framework for HHW disposal the efforts to control it would be unsuccessful. Surveys conducted showed that Malaysians are more willing to participate in a particular program if it is made compulsory by the government (Fauziah & Agamuthu, 2005, Irina *et al.*, 2004). Obviously, in order to improve the situation regarding household hazardous waste in MSW stream, the intervention by the Malaysian government is very essential. Specific policy should be implemented with regards to MSW and household hazardous waste in line with strict enforcement. This is to ensure regulations stipulated are not merely on papers.

Besides the implementation of appropriate policies, creating consciousness among the public is very important too. Massive campaigns and forums should be conducted to provide the public with better understanding on the impacts and consequences of HHW in the environment. Therefore, it is necessary to create a safe disposal routes for HHW generated by them.

Survey conducted indicated that 82% of the Malaysian public was awareness of various environmental issues (Fauziah & Agamuthu, 2005; Irina, 2004). However, they are not motivational enough to act and practice accordingly. Currently, due to the low level of consciousness on environmental issues, public participation in such programs was relatively low. This is so as various programs conducted by many NGOs to provide alternative HHW disposal routes received a poor participation from the public. This generally due to the lack of information on pollution impacts by these waste or available data was unreliable and ambiguous (Gatke, 2003; Krogstrup *et al.*, 2003; Agamuthu, 2001). The exposure to the information on the danger of improper HHW disposal will provide better understanding on the issues that public would be more alert and concern of their activities that gave impacts to the environment. By creating a concern society, programs to improve the waste management system can be successful when public are more participative and willing to cooperate in the program.

With the implementation of appropriate legislations on HHW management and cooperation from public, the collection and disposal system also need serious improvement. Developed countries like Denmark and Germany had developed proper systems for HHW collection, treatment and disposal that it can be monitored effectively (Kongstrup *et al.*, 2003). An appropriate collection and disposal system is currently is lacking in Malaysia particularly for HHW resulting of its presence in the MSW stream. Center set-up by NGOs that collects HHW also faced problems of the proper route to dispose these items (Gatke, 2003; Krogstrup *et al.*, 2003). Obviously, there is an urgent need for an improved collection and disposal system of HHW in the country.

4. CONCLUSION

Different socio-economic groups contribute different quantum of hazardous component with the high-income group being the biggest generator. The ever increasing rate of waste generation in Malaysia would increase the quantum of hazardous component received by the landfills. Therefore, various improvement and controlling measures are necessary in order to minimize and finally curb the problem of hazardous household waste contamination in the MSW stream and to the environment.

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