



Household Hazardous Waste Management in Malaysia

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ABSTRACT: The present study aimed at identifying the type of household hazardous waste (HHW) generated, and determining the HHW management practices and their related accident and diseases. One hundred households in a residential area in the southern state of Malaysia were randomly sampled. Results showed that the average weight of HHW is 0.025kg/d/hh and 0.4ml/d/hh is the average volume. The common household hazardous product found at home are Zonrox bleach, fabric dyes, paints, and medicine bottles. In terms of HHW practices, majority disposed their HHW together with other solid waste. Only a small number of respondents reported to experience skin irritation and poisoning.

KEYWORDS: household hazardous, waste management, residential area.

I. INTRODUCTION

Household hazardous wastes (HHW) constitute a new class of wastes from common household products. Household hazardous waste are waste generated at the household level that pose a potential hazard to living creatures because they are toxic or lethal, non-degradable or persistent in nature, and may cause detrimental cumulative effects. Any product that has a warning, caution, poisonous, toxic, flammable, corrosive, reactive or explosive warning is considered hazardous (O'Leary & Walsh, 1995). Household generated hazardous waste such as batteries, paints, solvent and pesticides may threaten human and the environment when improperly disposed even though the amount of hazardous waste generated by the household products is only a fraction of that generated by the industries (Denr, 1992). Collectively, such wastes and the hazards posed are a growing concern.

Even though the overall impacts of household hazardous waste disposal are not only fully known but potential concerns include health problems for homeowners, children and pets from improper storage and disposal by the homeowner. For example, injuries could happen while waste is being emptied, compacted, or transported. Spills and fire hazards at the collection and disposal sites, and pollution of air, groundwater and surface water are all possible outcomes resulting from improper disposal of hazardous waste. Due to the danger and risk posed by household hazardous wastes, good practices of management, handling, and disposal of these wastes should ideally begin in the household (O'Leary & Walsh, 1995). But to what extent such practices are currently being implemented need to be investigated so that proper measures could be identified and carried out by the authorities concerned. Hence, the present study was undertaken to deal with this issue. In particular, it sought to meet the following specific objectives: (a) to identify the type of household hazardous waste (HHW) generated, and (b) to determine the HHW management practices and their related accident and diseases.

Skudai is a rapidly expanding suburb of Johor Bahru, the largest city in and the capital of the state of Johor in southern Malaysia. Skudai is part of the new growth corridor of southwest Johor, which includes the Senai International Airport, Tanjung Pelepas Port, and the proposed new administrative capital of Johor, Bandar Nusajaya. Its population ranges between 160,000 and 210,000. It is the headquarters of the Johor Bahru Central Municipal Council and it is home to one of the public universities in Malaysia. Skudai is located 8 km, 4 km and 16 km from Kulai, Senai and Johor Bahru City, respectively. There are many nearby towns and housing areas, and one of them is Taman Universiti. Taman Universiti is a self-contained township situated about 20 km from Johor Bahru City with an excellent access through



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double-carriageway Skudai Highway and Pontian Highway. There are 12,299 residential units in Taman Universiti. The residential areas are managed by the Johor Central Municipal Council. With regards to waste collection, private contractors are appointed. At Taman Universiti, residents dispose of their household waste by putting it inside plastic bags, which will be placed outside their home to be collected by the private contractors. The private contractors collect the waste every Wednesday and Sunday at any time of the day.

II. MATERIALS AND METHODS

This study was concerned with obtaining relevant data on municipal solid waste in Taman Universiti, Johor Bahru catchment. Permits needed to carry out the study were sought through the coordination of Johor officials, government offices, and agencies. House-to-house interview and survey were conducted to know the actual condition of household hazardous waste. Out of 12,299 households located in Taman Universiti. To select the appropriate sample size, Slovin's formula was employed. Based on the formula, 100 respondents should be sampled. To select 100 households and HHW sample, cluster sampling was employed, in which every street where houses were located was considered as a relevant cluster. Random sampling was then used to determine the street, and hence all houses along the street were selected to participate.

To meet the first objective, a representative container, weighing scale, graduated cylinder and waste plastic bags were used during actual sampling. From the computed sample size of 100 respondents, generation of HHW was determined based on weight-volume analysis. The collection of solid waste was conducted every day for 23 days. Wastes were transported and loaded in a controlled area. Each collected solid waste was placed in a container and the HHW was segregated from the other components of the solid wastes. Mass of HHW was measured using weighing scale, while the liquid hazardous waste was poured into a calibrated graduated cylinder for the volume determination. HHW was computed using weight-volume analysis in which a mean value was determined. The mean is defined as the arithmetic average of the number of the individual measurements. To achieve the second objective, house-to-house survey was conducted in which questionnaire was used. The questionnaire asked different aspects related to household hazardous waste handling (e.g., types, separation, storage, home accidents, disposal, etc.). In the determination of the generated HHW and its management, collected data was tallied and analysed. Graphs, photographs, and tables were used to show the results. The data collection period lasted for one month, from September to October 2011.

III. RESULTS AND DISCUSSION

Table 1 presents the type of household hazardous products and their corresponding characteristics. The different types of products can be categorized into five main categories: (a) automotive products (e.g., gasoline, motor oil, brake fluid, wiper fluid); (b) home improvement products (e.g., paint (oil-based and latex), caulk, varnish); (c) health and beauty products (e.g., nail polish, finger nail polish remover); (d) pesticides (e.g., rat poison, flea killer, insecticides); (e) household cleaners (e.g., furniture polish, oven cleaner, toilet bowl cleaner); and (f) miscellaneous products (e.g., shoe polish, fabric dye, mercury). Majority of the homeowners (76%) were also found to use automotive products specifically gasoline because many own personal vehicles like motorcycles and four wheeled transportation. However, during the actual sampling, no gasoline waste was collected because respondents purchase rather than produce discarded gasoline. The lowest generated household hazardous products are roofing tar, organic solvents and ammunitions. But as shown in Table 1, many homeowners use common household products that can be dangerous when mishandled and can be hazardous when improperly disposed of.



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Table 1: Types of Household Hazardous Products and Their Characteristics

Types	Percentage of household	Characteristics
Gasoline	76	Flammable
Acids	73	Corrosive
Adhesives & glues	61	Flammable/Irritant
Fluorescent	59	Toxic
Cell phones	58	Flammable/Explosive
Medication	56	Toxic
Lighter fluid	55	Flammable
Spot removers	55	Flammable
Bowl cleaner	55	Flammable
Fingernails polish	54	Toxic/ Flammable
Insecticides	53	Flammable
Kerosene & oils	51	Flammable
Septic cleaner	50	Toxic
Shoe polish	50	Flammable
Toner	48	Toxic
Tile cleaner	46	Toxic/Corrosive
Lubricating oils	40	Toxic/ Flammable
Gas cylinders	40	Flammable
Paint stripper S-B	38	Flammable
Paint: S-B	38	Flammable
Rat poison	37	Toxic
Pesticides	37	Toxic
Pet spray	36	Flammable
Oven cleaner	34	Flammable
Paint: W-B	32	Flammable
Paint stripper: W-B	32	Flammable
Drain opener	30	Toxic/Corrosive
Brake fluid	30	Flammable
Bleach	28	Corrosive
Batt, rechargeable	28	Explosive/Corrosive
Art paints	27	Flammable
Antifreeze	27	Toxic/Poisonous
Batt, lead acid	26	Explosive
Batt, dry cell	25	Flammable
Aerosol cans	24	Flammable
Ammonia	23	Flammable
Capacitors	20	Flammable
Car wax	19	Flammable
Digital cameras	16	Toxic
Inkjet toner	18	Flammable
Disinfectants	15	Flammable
Wiper fluid	15	Flammable
Fabric dyes	13	Toxic
Furniture polish	13	Flammable
Caulk	12	Toxic
Mercury	10	Toxic
Mothballs	10	Toxic/Poisonous
Photo chemicals	9	Toxic/Poisonous



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Smoke detectors	7	Explosive
Varnish	7	Flammable
Fireworks	4	Explosive
Flea collar	3	Toxic/ Flammable
Wood stain	2	Toxic/ Flammable
Roofing tar	1	Flammable
Ammunitions	1	Explosive
Lead	4	Toxic

Table 2 and Figure 1 show the generation of solid HHW in terms of weight. The highest generation of HHW of 5 kg was recorded on the fourth day of data collection and the lowest generation was 0.5 kg on the fifteenth day. The mean value of solid HHW was 2.476 kg/d. In terms of liquid HHW, the highest generation was on the first day of 158 ml and the lowest generation was in the eleventh, sixteenth, twentieth, and twenty-second days where no generation was recorded. The mean value of liquid HHW was 39.73 ml/d. Figure 2 shows the result of liquid HHW.

Table 2: Household Hazardous Waste (HHW) Generation
(September 20 – November 11 2011) (n=100)

Date of Collection (Days)	HHW Generation	
	Weight of Solid HHW (kg)	Vol. of Liquid HHW (ml)
September 20, 2011	1.5	158
21	3	75
22	1	30
23	5	13
24	1.75	60
25	3	63.80
26	3	55
27	2	36
28	1	50
29	1	50
30	1.25	-
31	4	79
October 1, 2011	4	10
2	4.5	10
3	0.5	15
4	3.7	-
5	2	17
6	0.75	63
7	1.25	18
8	4.75	-
9	3.5	27
10	2.5	-
11	2	19
TOTAL	56.95	913.8
Mean	2.476 kg/d	39.73 ml/d

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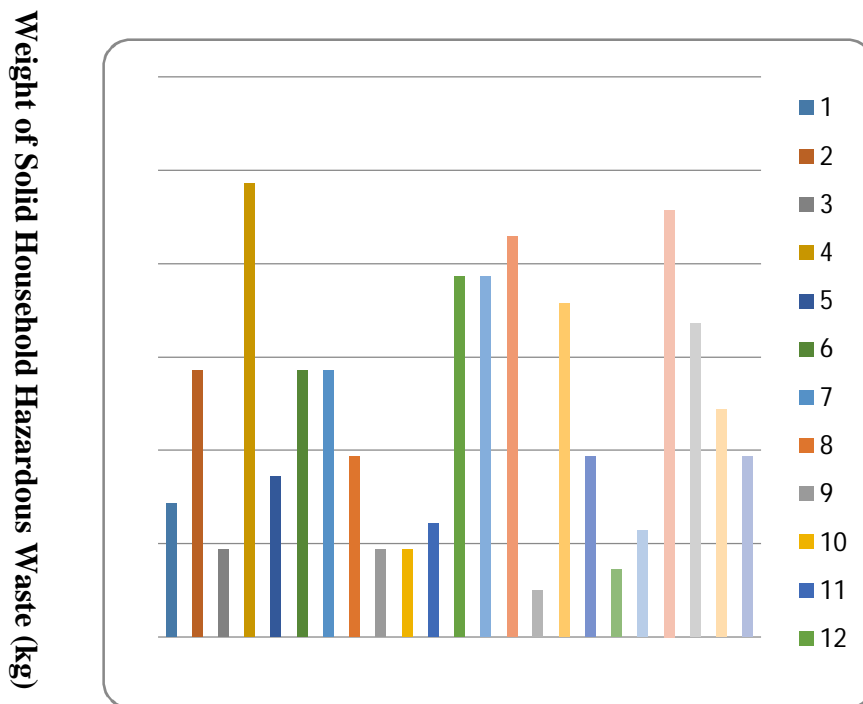


Figure 1: Weight of Solid Household Hazardous Waste (HHW) Generation in Days

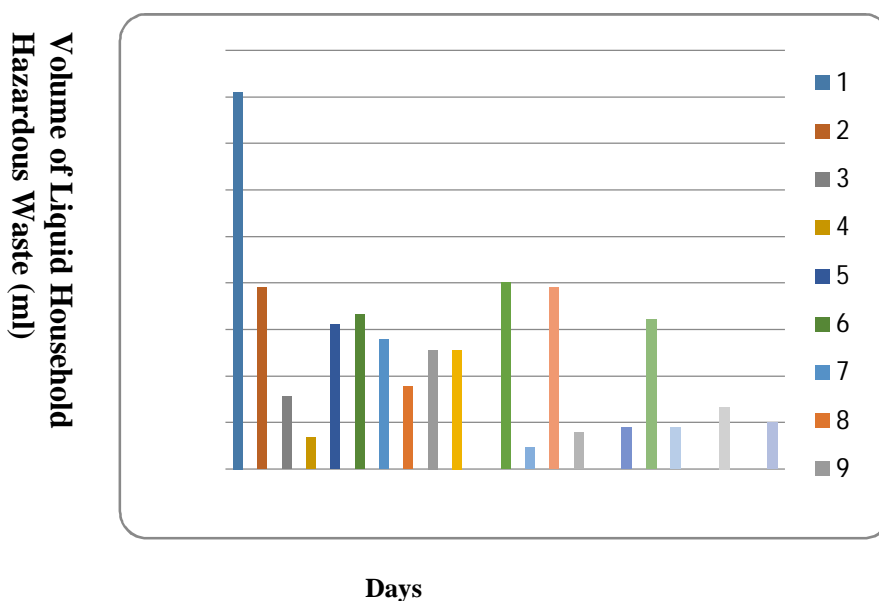


Figure 2: Volume of Liquid Household Hazardous Waste (HHW) Generation in Days

Results also show that the total weight of solid HHW generation during 23 days of data collection period was 56.95 kg, with a total average weight of 0.025 kg/d/hh. For liquid HHW, the total volume generated during the same period was 913.8 ml and the total average HHW volume was 0.4 ml/d/hh. Respondents were asked about whether they follow

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precautionary measures in handling household hazardous waste. They were informed that precautionary measure was defined as complying with the instructions given by the manufacturers on how to handle HHW such as making sure that direct contact with the skin is avoided and handling in such a manner that the environment will not be negatively affected. It was found that majority of the respondents (78%) reported that they follow the precautionary measures instructed while the remaining 22% indicated that they do not follow precautionary measures because they are not concerned with the possible effects of improper handling and disposal of HHW. Respondents were also asked about the practices they employed in storing household hazardous products. Majority of them (78%) indicated that they have separate areas for storing household hazardous product. One-third reported (30%) reported that the common place of storage is the garage to keep the said product out of reach of children and pets, 21% indicated that they have a specific area in the cabinet, 18% stored the product in the bathroom, and 9% in the kitchen. The remaining 22% reported that they have no separate intended area for storing household hazardous product. These wastes are stored anywhere in the house: some are even mixed up with other nonhazardous products. Figure 3 shows the distribution of the storage practices amongst studied households.

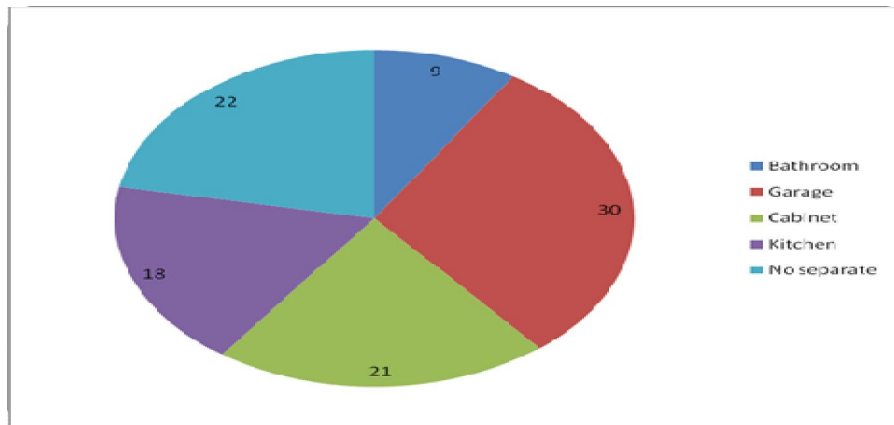


Figure 3: Distributions of Storage Practices on Household Hazardous Products

Figure 4 shows that about 68% of the homeowners reported that they dispose their HHW together with other wastes for the collection by the private contractor because it is the common and practical way of disposing the wastes, followed by 19% who indicated that they burn directly all their wastes because it is convenient for them to do so. A small percentage (10%) reported that they reuse the container for some other purposes while 3% indicated that they bury the wastes because some wastes explode if burned.

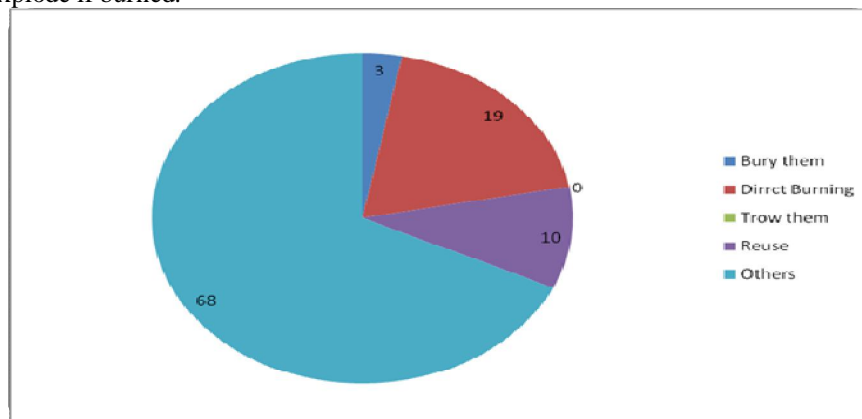


Figure 4: Distributions of the Respondents According to the Manner Disposal of Household Hazardous Waste (HHW) Respondents were also asked whether they had encountered any accidents when handling HHW. As shown in Figure 5, only 11% of the respondents encountered minor accidents when handling HHW and this include skin irritation/damage

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(9%) and poisoning (2%), suggesting that accidents might be encountered due to negligence and improper handling of HHW. The remaining 89% did not encounter any accidents while handling HHW as they strictly followed the handling instruction labeled on the container of the household hazardous products.

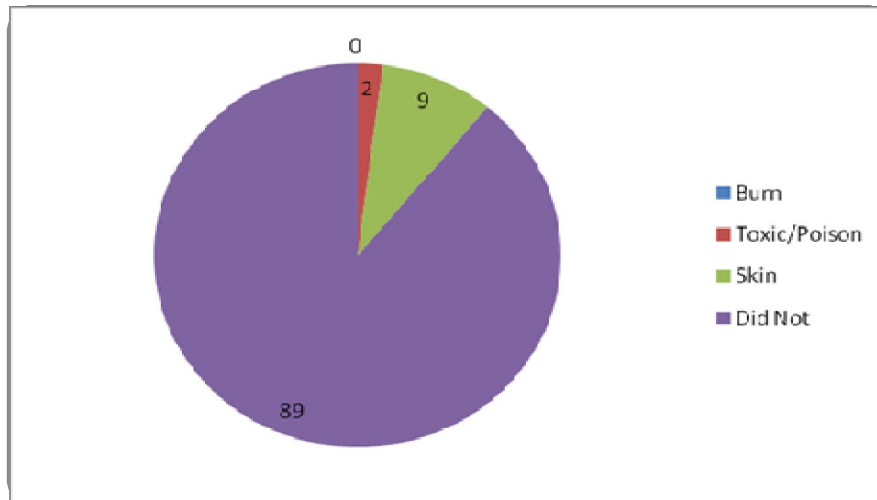


Figure 5: Minor Accidents Resulting from Improper Handling and Management of the Household Hazardous Waste

IV. CONCLUSION

The present study seeks to explore the types of household hazardous waste generated among residents in a residential area in Malaysia and the HHW management practices and their related accident and diseases. Key findings reported are as follows:

- The common household hazardous products found at home include automotive products, solvents, medicine bottles, household cleaners and polishers. Among the automotive products, gasoline (76%) is the most common products found at home because majority of the homeowner own personal vehicles. The lowest generated household hazardous product are roofing tar, organic solvents and ammunitions (1%). The types of HHW collected during the conduct of the study are mostly bleach, fabric dyes, paints and medicine bottles.
- The average solid HHW generation is 0.025 kg/d/hh while 0.4 ml/d/hh for liquid HHW
- Majority (78%) reported that they follow the precautionary measures instructed while the remaining 22% indicated that they do not follow precautionary measures because they are not concerned with the possible effects of improper handling and disposal of HHW.
- Majority of them (78%) indicated that they have separate areas for storing household hazardous product. Others reported the use of garage, cabinet, bathroom, and kitchen as places to store HHW. Some even reported they have no specific storage area at home.
- Majority (68%) reported that disposing of HHW together with other wastes is a common and practical way of doing so. Direct burning is also a convenient way to dispose of HHW.
- The common accidents related to HHW are skin irritation/damage (9%) and toxic/poisoning (2%) and the victims are mostly minors those ages from 7 to 12 years old.

Whilst the types of HHW generated by the studied households are somewhat common across many parts of the world indicated by previous studies (e.g., Guzman & Reyes, 2003; Hammet et al., 2002; Tanaka & Yasuda, 2006), it is the way the HHW is managed and handled that is eye opening. In fact, the findings of the present study seem to corroborate the report in the Star Online in 2008 on how Malaysians generally handle their HHW. It was reported that more than 64.7% end up in the garbage bin, 12.7% are poured down the drain, 2.4% are burnt and 20.2% are disposed of by other methods like burying or are just arbitrarily dumped (Loh, 2008). Indeed, the current practice of managing and handling HHW amongst the studied residents indicates the lack of awareness of the dangers and risks involved in improper disposal and handling of HHW. It also suggests the indifferent attitude the residents have on the effects of



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their action to the environment or health. This is reflected in the way they dispose of the HHW either by throwing it away together with other wastes for collection or directly burning them. Lack of awareness amongst households in handling and managing HHW has been reported elsewhere suggesting that this is one of the common issues in waste management. Indeed, no amount of measures will be effective without public awareness on the effects of improper handling and disposing of HHW. The findings of the present study further confirm the existing problem of public awareness on this issue. Even though the findings may not necessarily reflect the practices of the larger population in Malaysia, it sheds some light into the problem that the country is still facing in educating the public and creating awareness on the importance of good waste management. While the country still has a long to go in establishing a good system of and approach to HHW management in terms of storage, collection, separation, transportation, treatment and disposal of HHW to protect the health of its citizens and the environment, continuous effort and initiatives in awareness, training and capacity building program should be implemented. While the present study has provided some preliminary insight into the current practices of HHW management, further research on the effects of the household hazardous waste on the environment including the bodies of water and groundwater needs to be conducted. Such studies are needed so that the general public can be made aware of the danger of their practices to the environment, were such effects established.

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