

## **WASTE AUDIT IN UMT CAMPUS : GENERATION AND MANAGEMENT OF WASTE IN CAFETERIA AND FOOD KIOSK**

Izan Jaafar<sup>1,2\*</sup>, Tengku Azmina Ibrahim<sup>3</sup>, Noor Hayati Mat Ila<sup>3</sup>, Nor Syuhada Mohd Zaki<sup>3</sup>

<sup>1</sup>*School of Marine and Environmental Sciences, Universiti Malaysia Terengganu, 20130 Kuala Nerus, Terengganu, Malaysia*

<sup>2</sup>*Institute of Oceanography and Environment, Universiti Malaysia Terengganu, 20130 Kuala Nerus, Terengganu, Malaysia*

<sup>3</sup>*School of Ocean Engineering, Universiti Malaysia Terengganu, 20130 Kuala Nerus, Terengganu, Malaysia*

Email: izanjaafar@umt.edu.my

### **ABSTRACT**

Waste Management problem became the most challenging issues with the increasing of global population. Universities as higher educational institution should create knowledge, take a lead on environmental protection and sustainability practices for promoting public awareness on adapting the concept of sustainability for a better quality of living as well as integrate sustainability in their educational and research programs. In the aspect of solid waste management, solid waste audit need to be conducted for the determination of the total amount of waste generation, the current practise of waste management and waste characterization hence specific improvement can be identified and implemented. Cafeterias have been known to generate multiple waste such as biodegradable waste, recyclable waste and non-recyclable waste. Therefore this study was conducted to determine the generation, characterization and current management practices of waste produced within cafeterias and food kiosks currently operating within Universiti Malaysia Terengganu (UMT). The study involves distribution of questionnaires to 370 respondents, representative numbers based on UMT population of UMT that has reached 10900 and characterization of solid waste produced by the respected cafeterias and food kiosks for the duration of two weeks. The results found that the total generation of solid waste was 1753kg with average 125kg generation per day. Waste classification were 59% (food waste), 21 % (papers), 13% (plastics), 4 % (tin/aluminium), 1.3% (polystyrene), 1.2% (Glass) and 0.02% (Others). Estimation of the average waste generation was determined through weighted process using scale machine. The weighted waste were segregated according to their type and categories. The survey conducted found that majority of respondent have knowledge about solid waste management (>80%) but still lack of awareness towards solid waste management in cafeteria and food kiosk whether simply by recycling and separating. The survey also suggests that UMT community to bring their own containers for take away and to participate more in solid waste awareness programme. The high proportion of organic waste more than 60% exceeding the typical 40% national generation indicated a strong urge to place organic waste compost bin in cafeteria so that the highly generated organic waste can be utilized and converted into compost whilst reduce waste disposal cost.

**Keywords:** Waste Audit; Educational Institutions; Awareness; Waste Generation; Waste Characterization

## **1. INTRODUCTION**

The increasing number of municipal solid waste management has become the biggest environmental problem in Malaysia (Sin et al., 2013). The current practice of waste management in Malaysia is poor and it has become the main factor of the environmental issues especially the poor solid waste management (Samsudin & Don, 2013).

At present, Municipal Solid Waste (MSW) management in Malaysia totally depends on landfills for managing a daily waste disposal and approximately 95% of the waste are disposed into landfills (Tiew et al., 2014). Therefore, waste management costs have increase over the year and become a burden for economy but the highest concerns is the limited land for waste disposal in future.

The universities as an academic and research institutions should create knowledge and integrate sustainability in educational and research programs, as well for promoting the environmental issues to the communities (Ishak & Mahayuddin, 2013).

Institutional and commercial sector contribute 30% of total daily generated waste are required to carry out basic characterization that allows them to promote waste recycling practices and to develop strategies for the implementation of SWM (Ng & Yusoff, 2014).

A sustainable campus is defined as a campus have characterized by its operation, social and economy, and promote conservation of the environment. The concept of sustainable or green campus is an outcome for providing a sustainable life for the campus community such as the students, lecturers and the general all people who are involved in the university (Moezzi et al., 2014). Universities as centre of higher learning should play their role as a driver and obliged to act responsibly towards environmental issues. Universities have the social responsibility to teach the society how to overcome the problems caused by inadequate management of solid waste (Ng and Yusoff, 2014). Specifically it would be expected that universities would drive the efforts towards responsible waste management. Besides, appropriate waste management would bring benefits to the institution such as a reduction of the financial resources destined to waste management, but, above all, it would set an example to the students and the community (Vega et al, 2008)

## **2. PROBLEM STATEMENT**

Universiti Malaysia Terengganu (UMT) already published 'Blue Print for Eco Campus in 2014 however the implementation of the aspects listed in the documents are yet to be implemented. For achieving the status of campus sustainability, a comprehensive solid waste management programs are one of the greatest challenges. It is because the successful waste management is not an easy work as a holistic waste characterization need to be conducted as well as actions need to be taken to advance the overall sustainability aspects of an institution (Smyth et al., 2010).

In 2015, UMT population in are 10,876 and it is keep arising every year because of new intake students and new programs offered. According to Abushamala et al., (2010) the relationship of population growth and solid waste generation are directly related and became the main factor of waste generation. In the other words, as population increases, the generated amounts of the waste also increase. Generation of waste in cafeterias and food kiosk became the concern because it produces multiple types of waste, i.e. leftover food, plastic, paper and others. In contrast from academic building, administration buildings or lecture hall produces more solid waste like paper, aluminium and plastic bottle.

The challenge to achieve the sustainable environment is the biggest issues to implement for any sustainable campus. UMT have never conducted any study about the waste generation, therefore the data is important to support the identification of current waste management, and so that improvement plan can be made. The waste management problem have to be solved with the determination of the generation of waste from the University Departments, Academic Building, Cafeterias and other places that contribute to waste generation. Mostly, the cafeteria and food kiosk generate multiple types of waste, such as solid wastes and organic wastes.

Besides that, UMT's awareness level and behavior towards solid waste management in cafeteria and food kiosk also can be determined. So the study is relevant to be conducted for the determination of total of amount waste generated from the entire cafeteria and food kiosk coupled with awareness level in UMT regarding waste management. Therefore there is a need to research and to document waste composition in order to have the necessary data to propose better handling and management alternatives for solid waste

This study was conducted to determine the amount of solid waste generation and characterization from six cafeterias and two food kiosks operating in UMT campus and hostels. Current condition and practise of solid waste management within the university were also determined that can beneficially suggests the improvement steps need to be taken for better and more efficient solid waste management.

### **3.0 LITERATURE REVIEW**

Solid waste management (SWM) is defined as the associated discipline with controlling the rate of waste generation and with increasing of problem that give an affect to removal and collection factors of municipal solid waste transportation and it is directly affect adversely the productivity rate from the source of waste (Budhiarta et al., 2012).

In general, to improve the solid waste management service in developing countries, there is the urgent need to modernize the solid waste management system through the application of concept recycle, reduce, reuse (3R) (Behzad et al., 2011). Early exposure towards solid waste management is important so that public will understand that it can save the environment (De Feo & De Gisi, 2010)

Waste audit is a systematic procedure to review operations and subsequently, waste generation. The procedure will define the composition waste through examining the materials have been discarded or thrown away (Wilkie et al., 2015). The main purpose is to determine, to measure and analyse waste generated in functional places such as cafeterias, shop mart and others (Hall, 2011) to identify the total waste disposed by students in university and to determine the percentage of waste that can be recycled based on six categories: organic waste, plastics, paper, aluminium, glass, and others (Budin et al., 2007). The process include reviewing waste management records, visual waste assessments, interviewing waste management staff and extrapolating data from other institutions. The information from the audits will helps to identify the current waste generation also the technique for improvement the waste management can be created.

Presently the green campus concepts have been implemented through the university management because the prospect to overcome the waste problems gives a positive change for sustainable life (Moezzi et al., 2014). Besides that, Smyth et al., (2010) also stated the

proper waste management would bring the benefits to the university management with reduction of the financial for waste management cost. But, most importantly through of these efforts it will give good examples to the students and publics. The universities is well known suited to take lead on environmental protection and sustainability practices for promoting sustainability on campus, universities and colleges through teaching and demonstrating principles of awareness and stewardship of the natural world and increase societies' environmental sustainability (Kaplowitz et al., 2009).

Several solid waste characterization, generation and management studies within local university campus and cafeterias have been conducted such as in Universiti Malaysia Sarawak (UNIMAS), Universiti Malaysia Perlis (UNIMAP) Universiti Malaysia Sabah (UMS), Universiti Teknologi Mara (UiTM), Universiti Kebangsaan Malaysia, Universiti Malaya and University Technology Petronas (Almunir & Adam, 2009; Pua, 2012; Kamsia et al., 2006; Ishak & Mahayuddin, 2013; Tiew et al, 2010; Ng & Yusoff, 2014 & Malakahmad et al, 2010). The solid waste characterization from those respected studies were in the range of 30% - 53% (food waste), 14% - 40% (papers), 9% - 24% (plastics), 3% - 3.4% (tin/aluminium), 4% (polystyrene) and 2% (glass).

Waste characterization studies conducted at colleges and universities gives specific opportunities for waste minimization and recycling which an crucial step towards greening the campus (Keniry, 1995; Creighton, 1998). Waste characterization studies in the University campus able to generate administrative support, cooperation among students, faculty and staff and inspire further involvement in campus sustainability issues (Sharp, 2002). Moreover, proper waste management would bring benefits to the institutions such as financial reduction.

Studies on the generation and characterization of municipal solid waste is one of factors need to be considered before proposing any management option. The decision making to lead an adequate SWM need to refer to the baseline date provided by such studies as they will provide the detail condition of the waste stream hence the suitable approach can be taken.

#### **4.0 METHODOLOGY**

This study was conducted for a duration of two (2) weeks at six cafeterias namely Teratai D'café, Kafeteria Sheikh Abdul Malek (KKSAM), Kafe KoUMT, Kafeteria Kolej Kediaman Abdul Rahman Limbong (KKARL), DD Cafeteria, KoSiswa Cafeteria and two food kiosks (located at parking space & academic building). The quantification for the food waste generation and characterization were conducted through weighing and physical process. Typically, the waste generated within the cafeterias and food kiosk in campus were collected and disposed around 4 pm everyday. For this particular studies, the wastes were detained for the purpose for quantification for their characteristics and generation. Wastes produced were weighted to determine their total mass and sorted according to food waste, papers, plastics, tin/aluminium, papers, polystyrene and others.

The questionnaire distribution consists the enquiries on the current practise and knowledge of UMT population on solid waste management. Questionnaires were distributed to 370 respondent, representative numbers according to Krejcie & Morgan (1970) method, from the total population of 10876.

## 5. FINDINGS

### 5.1 Total and average Solid Waste Generation and Characterization in UMT Cafeterias and Food Kiosks

The results reported herein were in cumulative amount for two weeks duration disregard the comparison during weekdays and weekend. Generally, total solid waste generated for two weeks duration was 1753kg or in average 125 kg/day. Cafeterias in UMT serves ready cooked food and only three out of six cafeterias serve hot food. Food kiosks served food such as nuggets, fishball, fishcakes, snacks and drinks which provides lots of plastic packaging for take away. Table 1 showed the total and average amount of solid waste generation and characterization classified into food, papers, plastics, tin/aluminium, polystyrene, glass and others.

**Table 1:** Total and average Solid Waste Generation and Characterization in UMT Cafeterias and Food Kiosks

Type of Waste	Total Weight (kg/14 days)	Percentage (%)	Average Weight (kg/day)
Food	1033.7	59	73.8
Papers	367.02	21	26.2
Plastics	235.3	13.4	16.8
Tin/Aluminium	72.3	4.1	5.2
Polystyrene	22.7	1.3	1.6
Glass	21.7	1.2	1.6
Others	0.30	0.02	0.02
Total	1753	100	

As can be seen in Table 1 above, food waste was the highest generation which was 1033.7 kg/2 weeks in total (59%) or 74 kg per day. This followed by papers (367 kg/21%), plastic (235kg/13.4%), tin/aluminium cans (72.3kg/4.1%), glass polystyrene (22.7kg/1.3%), glass (21.7kg/1.2%), and others (0.3kg/0.02%). The average generation were 74kg/day, 26.2kg/day, 16.8kg/day, 5.2kg/day, 1.6 kg/day, 1.6kg/day and 0.02 kg/day respectively.

Compared to the studies in several local universities, eventhough the characterization of the solid waste generation followed the typical trends, the 59% generated in UMT was the highest. However, it is worth to be noted that as this study focused on the generation particularly from cafeterias and food kiosks, hence the high percentage. Cafeterias, restaurant and food kiosks are areas generated large generation of food waste (Hazruwani, 2010). Food waste dominated the largest composition of waste in cafeteria because of the activities from kitchen such as food preparation, cooking and cleaning at the cafeteria (Zarak & Adam, 2009). The high composition is influenced by the student lifestyle of buying packed food instead of having their meals at the stall or restaurant (Ishak & Mahayuddin, 2013). Students who had their meals (packed food) in their hostels threw away the leftovers into the bins.

Basically, food waste can be reduced through educating the students and staffs with the aims to change their behaviours from throw away the leftover food. But, the collected

food waste can be recycled using composting or anaerobic digestion method in order to generate beneficial end products, including soil amendments and bioenergy. A study conducted by Mbuligwe, (2002) reported a waste recovery potential of 71% in three institutions of higher education in Tanzania. He also suggested that institutions should study and practice reutilization of food waste by delivering it to animal farming which use the waste as animal feed. Therefore, composting these waste should become a regular practice in the campus.

The massive amount of paper was contributed by the eating activities at cafeteria. Majority of cafeterias owner using paper as plate liner for dine in to avoid water consumption to clean the plate and minimise labour works. Moreover, the usage of paper wrapper was also the main contributor to the high generation as they are using paper packaging for take aways. However, this type of paper waste are unfit for recycling as it mixed with leftover food.

Second highest generation found was plastics. Nowadays, packaging for food are mostly using plastic materials. Wilkie et al., (2015) stated there is biggest difference in paper and plastic generation rates because the usage of plastic as a packaging material has increased significantly in recent years. However, in cafeterias and food kiosks, plastics container such as sauce dispenser, butter container, food container and oily plastic bottles cannot be recycled (Ahmad, 2007). Moreover, plastics needs more than 500 years to be decomposed when sent to landfill.

Polystyrene is extremely light hence the 22.7kg generation of polystyrene for two weeks were deemed significant. From the survey, 29.4% respondent preferred to use polystyrene to take-away rather than brought their own container. Besides that, majority of cafeteria owner still provides polystyrene as a food container rather than using paper wrapper. Society's habits to 'take-away' have increase to use of polystyrene because it is easier and its durability and water-proof ability (Ng & Yusoff, 2014). Supposedly, the usage of polystyrene should be lessen or to such extend should be banned as it is difficult to be decomposed (Munisamy, 2012). Materials in polystyrene pose hazardous threat towards human health and the environment. UMT had organized several campaigns on banning the usage of polystyrene but to no avail as they were one off campaign and the practised were not sustained.

## **5.2 Knowledge about solid waste management**

Majority of respondents (> 80%) stated that they have and sometimes heard about solid waste management and only about 7% never heard about the terms. The respondent stated that television (78%) was the main medium of obtaining information on SWM, the rest were from campaign activities (58%), newspapers (61%), radio (34%), clubs and societies (33.4%), magazines and templates (29%), lectures (5.4%). According to Alexander & Hasnon (2006), mass media were very cost-effective as an important of communication in society because they were also fast, flexible and relatively easy to plan and control.

The percentage of respondent who concern about solid waste were fairly proportioned where 49% stated they concerned while 51% did not. This figures were worrying as whilst when partial population didn't take the initiative to learn about SWM, thus contributed to the increasing of the waste generation as the concept of waste minimization (3Rs) are not in the picture. What was more worrying was the facts that only 35% respondent concerned about the proper SWM practised in cafeterias and food kiosks while

65% did not. It is significant and evident that sufficient information and exposure on proper SWM need to be continuously supplied from time to time.

### 5.3 Waste separation

Through waste separation, food waste, recyclable waste and non recyclable can be distinguished and disposed in a correct manner accordingly. Significant 95% of the respondent were strongly agreed and agreed (55.6% and 39.5%), that all cafeterias should practise waste separation This high percentage indicated that waste separation are important in minimising waste as well as improving the current solid waste management practise.

In one of the study area which is in DD Cafeterias which is located in library building, waste separation are taking place. However, the separation are only includes plates and cups, cutleries and food waste excluding recycle bins. It is suggested that recycle bin should be placed next to general bin to educate customer on recycling.

### 5.4 Problems associated with solid waste management

One of important aspects in the questionnaire were the problems that might caused the improper SWM within the university. Table 2 showed the percentages on the respondents' opinions towards problems that adhere the improper management of solid waste.

**Table 2:** Problems associating with solid waste management in UMT

Problems	Percentage (%)					Total Agree + Strongly Agree
	Strongly disagree	Disagree	Neither	Agree	Strongly Agree	
Large amount of waste generated	0.8	3.2	11.6	59	25	84
Waste are not segregated accordingl to its category	1.6	3.8	10	56.8	26.5	83.3
Lack of dustbin facilities	1.4	9.7	16.5	51.6	20	71.6
Lack of recycle bin facilities	1.1	9.0	17.6	42.4	29.5	71.9
Drainage blockage	0.8	10.5	23.8	46.2	18.1	64.3
Odor problem	0.5	6.5	13.2	52.4	26.8	79.2
No specific container provided to separate the waste such as spoon/plate/glass	4.1	15.7	21.4	46.8	12	58.8
Public do not aware about the benefit of waste management	0.3	5.1	13.5	49.5	31.4	80.9

From the results obtained, we can say that more than 70% were lack of the facilities provided. Almost similar percentage (83% - 84%) of abundance of waste and no separation took place indicated that indeed solid waste in cafeterias and within the university were not separated accordingly. When most of the students spending their times in campus and purchased food from the cafeterias, the quantity of the bins need to be upgraded. Furthermore, the lack of recycle bins in hot spot areas and in particular no recycle bin provided at all in cafeterias, limits waste minimization activities through recycling. The high percentage of 81% respondent which stated that they did not aware on the benefit of proper waste management gives strong indication that the message of good practise need to be aggressively conveyed.

## **5.5 Recycling Practise**

Findings showed that only half of the respondent practice recycling. If we are to compare with the national recycling rate of 10%, the figures are way promising. However, in the aspiration of green campus, recycling activities should be at maximum rate. Minimising the quantity of wastes that have to be handled, transported and disposed in a landfill could lead to two main results: (1) a reduction of the institutional expenditure dedicated to waste management and (2) an increase of the lifespan of the sanitary landfill (Vega et al, 2008). Besides these benefits, a reduction in the amount of waste produced by universities would also serves environmental and social benefits (WWF, 1991)

It was not a surprised that most respondent chosed the highest recyclable materials was paper (95%), followed by plastics (87%), tin/aluminium cans (75%) and glass (60%). Suited with their daily activities, papers and plastics were among the major component students will use and generate daily. This figures suggested that suitable facilities needed to be placed in the university. As mentioned earlier lack of facilities was one of the factor influenced recycling activities, therefore for those who practise recycling, they will only be able to dispose their recyclable materials in the bin provided in the campus.

53% respondents were willing to involve in recycling activities as the activity were normally volunteered based program that involved community conducted outside university and while 32% chosen to involve in campaign. Less percentage stated they would involve in the typical talk and lecture (11.2%). Nowadays, with a vast rapid of technology in delivering the knowledge and input about recycling, more attractive approach will be needed to influence public to involve in recycling activities. Knowledge and awareness on waste sorting and recycling should be a major input in any awareness programme. It should emphasized on the considerable change in the attitude and perception of the community in the campus towards solid waste management. With variety of mechanism to attract public, it is hoped that it will eventually change their habit and also behavior towards good solid waste management practice (Ishak & Mahayuddin, 2013).

## **5.6 Improvement steps for solid waste management within cafeterias and food kiosks.**

One of the suggestions highlighted in the questionnaire was whether respondent agree to bring their own container to consume food and for take away. The findings stated that 12% of the respondent were strongly agree, 38% agree, 35% disagree and 15% strongly disagree. This results indicated positive mechanism can be implemented in the university by



encouraging its population to minimise food packaging hence numbers of papers, plastics and polystyrene can be lessen.

It is worth to be listed factors that hinders recycling and waste minimisation activities thus proper steps and actions to improve the practices can be taken. Among the factors that limits the recycling activities were no recycle bins/ recycling facilities provided (27%), no time to conduct recycling (23%), lack of awareness (15%), no incentives given (15%), lack of information how to conduct recycling (5%), wasting time (3%) and others (2%). If those factors can be tackled by the university, it is no doubt that recycling rate among university population can be increased.

## **6. CONCLUSIONS & RECOMMENDATIONS**

Waste audit are significant tools to collect data on the waste generation for conservation, recycling status, compost activities and waste minimization to achieve the aspiration of green campus. The implementation of sustainable campus involves the coordination from the micro level to the top of management context, as well the hierarchy of waste minimization.

The highly generation of solid waste (125kg/day) indicated there is strong urge that all cafeterias and food kiosks should practise waste separation that can minimise disposal cost and provide better solid waste handling. Most respondent aware and already obtained knowledge on SWM management however they did not inculcate on what they were preached hence the low percentage in terms of good practice were still the norm. This study strongly suggest that if we are to reduce the significant 59% of food waste and the respected percentage of recyclable waste; waste separation, waste minimization and recycling must be promoted aggressively. Composting can be significantly benefit to handle the high amount of food waste generated everyday. This would not only save disposal cost but the compost can be used as fertilizer for flowers and gardens in the university.

Proper waste management in cafeterias and food kiosk can be achieved with the proper and sufficient approach. Series of attractive programs, introduction of guidelines and eventually policy can be issued to guide and encourage population within the higher education institutions for the establishment of foundation for an integrated waste management. Integrated waste management programs within the educational institutions will teach the community that how, with very simple, but constant and organized practices, it is possible to alleviate the problems caused by inadequate management of solid waste. This SWM practices adopted by higher education institutions have a great potential of being adopted and portray a good example to be implemented and practised by surrounding communities.

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