



Zero Waste Campaign of University of Malaya

2014 Annual Report

Prepared by,



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Section 1: Introduction

Sub-section 1.1: Background of ZWC

Zero Waste Campaign (ZWC) was introduced in 2010, after OWD (organic waste diversion) team (rooted from VeeCYCLE) received funding from CIMB Foundation to implement a composting project and recycling program. The ZWC composting project was commenced in September 2011 with participation of food waste segregation program from residential colleges, technical assistance (Takakura composting) from IGES (Institute for Global Environment Strategies) as well as facility and collection system support from JPPHB and TNC (Development).

The composting method was eventually evolved into aerated static piles with capacity of 4-5 ton/month (90% food waste and 10% green waste, by weight). In 2013, Cowtec ® anaerobic digestion (AD) 100kg/day unit was installed after aresearch collaboration with CH Green Sdn Bhd. With the AD facility, about 1 ton of food waste is converted to biogas and bio-fertilizer every month. Until end of year 2014, about 120 ton of organic waste had been composted or treated anaerobically by ZWC.

In year 2015, ZWC extended the landfill diversion project with recycling of two (2) more waste streams: waste textiles and wood waste. Used clothes and waste textiles are collected separately with ten (10) units of “drop-off” collection bins while wood waste is collected by JPPHB in separate open top bin for energy recovery in a paper mill.

Throughout the past three (3) years, ZWC received numerous visitors from various organizations (academic, government, private sector and NGO), as well providing supports and facilities for several students to carry out research related to organic waste treatment and waste characteristic studies.

Sub-section 1.2: Brief review of ZWC in 2014

Year 2014 is an improvement year for Zero Waste Campaign (ZWC) with more collaboration with industries to establish separate collection of various waste streams, collaboration with academic institutions for research, more appearance in environmental conferences, expo and media, and strengthening rapport from UMCARES and JPPHB. The public private partnership (PPP) between ZWC (UM) and several private entities had resulted in successful separate collection of waste streams for recycling/landfill diversion.

At the beginning of 2014, ZWC collaborated with Life Line Clothing (LLC) Sdn Bhd to introduce a used clothes collection program which had expanded rapidly in year 2014 that saw the collection of more than 20 ton of used clothes and waste textile. At the end of the year, ZWC formed partnership with TSP Waste Management to kick off a wood waste separate collection system for energy recovery which is implemented smoothly with about 5-6 ton/month capacity in the first month.

The support from UM top management, especially DVC (Development) to ZWC, is very important to ensure the success of the PPP. For instance, the sites approval to LLC to place the used clothes collection bins and cooperation to collect wood waste separately in a dedicated open top Ro-Ro bin for wood waste recycling. The DVC (Development), Prof. Faisal Rafiq had allocated budget for the upgrading of ZWC facilities in year 2015 such as new ZWC building, green waste shredder, a weighbridge station and composting center. Under DVC (Development), JPPHB assists ZWC in the provision of several manual workers, waste and recycling data as well as collection receptacles for food waste such as bins and bags.

In 2014, ZWC actively participated in several road show/exhibition and conference as well as visits to other facilities. In Feb, ZWC participated in an eco

conference in UMS with a paper presentation. In April, ZWC carried out a road show program, while in June, ZWC set up an exhibition booth in one higher education research event in UPM. In Dec, ZWC obtained several awards in conjunction with the UMCARES Summit/exchange conference. In August, ZWC also participated in ASEP 2014 in China. In Sept, ZWC stood at one of the booths under UM in IGEM2014. ZWC appeared in local media such as Harian Metro, Utusan and Astro Awani. All these programs that ZWC participated enable the publicity and promotion of ZWC's activities.

In term of facilities and equipments, ZWC had bought a 1-ton weighing scale for the more convenient and effective weighing of food waste and green waste collected for composting and anaerobic digestion. ZWC also bought an open top Ro-Ro bin for the storage of wood waste that is collected separately. Several recycle bins were put in several places in UM campus to facilitate recycling collection as well. In May, all the compost piles under the canopies were moved to a vacant site under the TNB transmission line right behind the existing ZWC facility. With the new site, the composting capacity is expected to be increased gradually with larger piles and longer composting duration to enhance compost quality by longer maturation period.

In 2013, there were various visitors from different parties such as academic institutions, government agencies, private sectors and NGOS. The visit also resulted in research collaboration such as with UMT on compost microbiology reseach. A recycling collection day was carried out by ZWC in Oct, from several sites in UM campus. About 1 ton of recyclables were collected in that particular day. For e-waste “bring” drop-off collection point at ZWC site, there were two collections by e-waste recycling company, with total weight of about 800kg.

By and large, 2014 marked a significant year for ZWC, especially in internal support and external smart partnership. ZWC is constantly looking for opportunity to overcome the challenge of informal recycling acidities and waste data

collection to further develop integrated waste management system in the campus of UM. At the moment, almost all the waste arise in UM campus are disposed of properly to sanitary landfills (Jeram and Bukit Tagar) as well as recycled or treated. Construction and demolition waste remains the single most challenging waste stream that disposal destination is unknown.

Figure 1.0: Goals & objectives of ZWC

Goal: To achieve a campus with zero waste to landfill with the development of integrated and sustainable waste management model

Objectives:

1. To develop policy and innovation system to divert solid waste (non-hazardous) from disposal in landfill for resource and energy recovery.
2. To streamline recycling activities and strategize efforts to increase recycling rate.
3. To create awareness and inculcate best practice of waste separation at source among the campus communities.
4. To form strategic partnership with various stakeholders to develop integrated waste management system.
- 5.

Significance of ZWC

1. Serve as a long term campaign to achieve integrated waste management model and ultimately a zero waste campus
2. Initiate projects, research projects and schemes such as Green Bag Scheme, in-house composting center, anaerobic digestion project, recycling collection system, waste characterization, composting emission study, etc
3. A model of system innovation to shift toward sustainable waste management

Section 2: Achievements in 2015

The various highlight of achievement of Zero Waste Campaign are as below:

Sub-section 2.1: Used clothes and waste textile recycling program

Sub-section 2.2: Road show / exhibition at Earth Day, UPM & IGEM 2014

Sub-section 2.3: Eco-conference in UMS

Sub-section 2.4: New composting site

Sub-section 2.5: Collaboration with UMT on compost research

Sub-section 2.6: Visitors to ZWC in year 2014

Sub-section 2.7: Wood waste separate collection for energy recovery

Sub-section 2.8: ZWC's appearances in local media

Sub-section 2.9: E-waste "bring" drop-off collection

Sub-section 2.1: Used clothes and waste textile recycling program

ZWC was engaged by Life Line Clothing Sdn Bhd (LLC) in January 2014 to initiate a used clothes and waste textiles collection program in the campus of UM. After several discussions and meeting with Mr. Vinod and Mr. Dale (CEO) of LLC, ZWC proposed the program to DVC (Development) and obtained the approval.

Two units of 4-chutes bins were placed at main library and food court of KK7 and the result was quite positive (200-400kg/week). Another two bins were added in April and four more in July 2014. With a total of nine bins in UM campus, about 2.5 to 4.0 ton of used clothes and waste textiles were collected for reuse and recycling every month. ZWC carried out a visit to LLC's factory in March 2014. Until the end of Dec. 2014, a total of 21,591.2kg of used clothes were collected through the program, which is a success. The collection data is shown on the table as in the next page.

Table 2.0: Used clothes collection data (Feb. – Dec. 2014)

Date		Location								KK9 community	Total
Start	End	Library	Food court	Medical	Exit Bangsar	1st college	12th college	9th college	8th college		
3-Feb	9-Feb	140	43.2	NA	NA	NA	NA	NA	NA	NA	183.2
10-Feb	16-Feb	170.6	17	NA	NA	NA	NA	NA	NA	NA	187.6
17-Feb	23-Feb	154.2	144.5	NA	NA	NA	NA	NA	NA	NA	298.7
24-Feb	2-Mar	226	173.9	NA	NA	NA	NA	NA	NA	NA	399.9
3-Mar	9-Mar	162	117	NA	NA	NA	NA	NA	NA	NA	279
10-Mar	16-Mar	138.7	37	NA	NA	NA	NA	NA	NA	NA	175.7
17-Mar	23-Mar	104.6	37.9	NA	NA	NA	NA	NA	NA	NA	142.5
24-Mar	30-Mar	45	18	NA	NA	NA	NA	NA	NA	NA	63
31-Mar	6-Apr	157.3	59	NA	NA	NA	NA	NA	NA	NA	216.3
7-Apr	13-Apr	123	35.2	35.2	105.4	NA	NA	NA	NA	NA	298.8
14-Apr	20-Apr	65.4	65.4	0	87.1	NA	NA	NA	NA	NA	217.9
21-Apr	27-Apr	58.8	29.4	78.5	58.8	NA	NA	NA	NA	NA	225.5
28-Apr	4-May	159.8	112.8	141	75.2	NA	NA	NA	NA	NA	488.8
5-May	11-May	109.9	44	98.9	175.8	NA	NA	NA	NA	NA	428.6
12-May	18-May	84.3	63.2	126.4	84.3	NA	NA	NA	NA	NA	358.2
19-May	25-May	200.5	26.7	133.7	106.9	NA	NA	NA	NA	NA	467.8
26-May	1-Jun	105.6	63.3	147.7	84.5	NA	NA	NA	NA	NA	401.1
2-Jun	8-Jun	102.2	51.1	40.9	81.7	NA	NA	NA	NA	NA	275.9
9-Jun	15-Jun	79.1	59.4	79.1	79.1	NA	NA	NA	NA	NA	296.7
16-Jun	22-Jun	94.7	56.8	75.8	75.8	NA	NA	NA	NA	NA	303.2
23-Jun	29-Jun	110.8	88.7	66.5	166.2	NA	NA	NA	NA	NA	432.2
30-Jun	6-Jul	162.4	216.5	86.6	108.3	86.6	129.9	108.3	NA	NA	898.6
7-Jul	13-Jul	188.6	75.4	94.3	141.5	18.9	141.5	0	NA	NA	660.2
14-Jul	20-Jul	135.8	79.2	113.2	90.6	45.3	22.6	67.9	NA	NA	554.6
21-Jul	27-Jul	183	85.4	122	183	48.8	97.6	73.2	NA	NA	793
28-Jul	20-Aug	No collection ; Semester break									
21-Aug	27-Aug	227.9	114	171	284.9	91.2	114	136.8	NA	NA	1139.8
1-Sep	7-Sep	215.4	53.8	107.7	376.9	161.5	215.4	86.1	43.1	NA	1259.9
8-Sep	14-Sep	12.3	122.6	183.9	196.1	98.1	73.5	36.8	98.1	NA	821.4
15-Sep	21-Sep	211.7	21.2	63.5	211.7	84.7	158.8	21.2	21.2	NA	794
22-Sep	28-Sep	142.6	76	95	142.6	38	95	28.5	18	NA	635.7
29-Sep	5-Oct	95	76	95	95	57	38	57	0	NA	513
6-Oct	12-Oct	149.2	59.7	99.5	59.7	59.7	79.6	59.7	0	NA	567.1
13-Oct	19-Oct	158.2	42.2	84.4	84.4	63.3	84.4	63.3	0	NA	580.2
20-Oct	26-Oct	154	20.5	61.6	205.3	120.6	30.8	5.1	20.5	256.6	875
27-Oct	2-Nov	190.1	50.7	101.4	253.4	25.3	101.4	19	25.3	63.4	830
3-Nov	9-Nov	138.1	55.2	165.7	207.2	27.6	82.9	41.4	27.6	110.5	856.2
10-Nov	16-Nov	120.2	72.1	120.2	96.1	72.1	96.1	24	24	24	648.8
17-Nov	23-Nov	109.4	43.8	87.5	131.3	0	65.7	32.8	21.9	65.7	558.1
24-Nov	30-Nov	80	60	40	60	0	80	30	20	60	430
1-Dec	7-Dec	80	5	30	80	0	60	30	30	60	375
8-Dec	14-Dec	150	20	50	100	80	0	40	20	40	500
15-Dec	21-Dec	80	40	20	170	0	70	50	30	70	530
22-Dec	28-Dec	40	30	100	220	80	50	40	20	50	630

Total collection: 21,591.20kg

Figure 2.0: Visit to Life Line Clothing factory at Port Klang

	Group photo
	Sorting of used clothes
	Bundle of clothes

Figure 2.1: Used clothes collection bins in UM campus (1)




	<p>Food court at 7th residential college</p>
	<p>Main library</p>
	<p>Exit KL junction</p>

Figure 2.2: Used clothes collection bins in UM campus (2)



1st residential college



8th residential college



9th residential college

Figure 2.3: Used clothes collection bins in UM campus (3)

	<p>12th residential college</p>
	<p>Medical faculty</p>
	<p>Program poster</p>

Sub-section 2.2: Road show / exhibition at Earth Day, UPM & IGEM 2014

ZWC had participated in several road show and exhibitions in the year of 2014, with the notable are during Earth Day in UM in April, an exhibition for higher education research in UPM in May and IGEM 2014 in Sept. Through the road show and exhibition, ZWC was able to promote the importance of organic waste recycling and integrated waste management system development in a campus level. For the Earth Day event in UM, ZWC also organized a seminar on Klang Valley River of Life (RoL) project with three prominent speakers from AECOM, JPS and DBKL. During the exhibition events in UPM and IGEM 2014, ZWC booth was visited by various parties.

Figure 2.4: Road show during Earth Day 2014

 A photograph showing a large green exhibition board with multiple panels displaying various environmental posters and information. The board is set up under a white event tent. A timestamp in the bottom right corner reads "22/04/2014 10:52".	Exhibition board
 A photograph showing a group of people, some wearing green shirts, gathered around a table covered with a white cloth under a large white tent. They appear to be in a briefing or discussion. A timestamp in the bottom right corner reads "22/04/2014 11:31".	Briefing of the road show
 A photograph showing a ZWC booth set up outdoors. A prominent sign reads "RECYCLE TODAY!" with a recycling symbol. The booth is located near a building and trees. A timestamp in the bottom right corner reads "22/04/2014 09:03".	ZWC booth

Figure 2.5: Seminar on River of Life

 A wide-angle photograph of a large audience seated in a hall. The audience is diverse in age and is seated on tiered benches. A man in a yellow shirt is visible in the foreground on the left. The hall has a high ceiling with square lights. A timestamp '29/04/2014 11:17' is visible in the bottom right corner of the photo.	<p>Question and answer session</p>
 A photograph of a woman wearing a white hijab and a pink patterned top, speaking at a white podium. She is holding a microphone and a piece of paper. The background is a plain wall with a door. A timestamp '29/04/2014 11:19' is visible in the bottom right corner of the photo.	<p>Opening speech by AP Dr Sumiani Yusoff, principal coordinator of ZWC</p>
 A photograph of three men seated on a stage. The man on the left is wearing a white shirt and dark pants. The man in the middle is wearing a green and white patterned shirt. The man on the right is wearing a light blue shirt. They are all looking towards the left. The audience is visible in the background. A timestamp '29/04/2014 11:17' is visible in the bottom right corner of the photo.	<p>The three speakers</p>

Figure 2.6: ZWC booth at UPM exhibition

 A photograph of the ZWC booth at the UPM exhibition. The booth features several large blue and white recycling bins, a digital display screen, and various informational posters. A woman in a pink hijab is standing near the bins. The background shows other exhibition booths and a "SUSTAINABILITY" sign.	<p>ZWC booth at UPM exhibition</p>
 A photograph showing AP Dr Sumiani, a man in a dark suit, briefing a group of people. A woman in a pink hijab is gesturing towards a display on the booth. The background shows other exhibition booths and a "SUSTAINABILITY" sign.	<p>AP Dr Sumiani briefed the deputy minister of education</p>
 A photograph showing AP Dr Sumiani, a man in a dark suit, being interviewed by a group of people. A woman in a pink hijab is gesturing towards a display on the booth. The background shows other exhibition booths and a "SUSTAINABILITY" sign.	<p>AP Dr Sumiani was interviewed by reporters</p>

Figure 2.7: ZWC booth at IGEM 2014

 A photograph of the ZWC booth at IGEM 2014. The booth features a green and white color scheme with a large 'ENGAGEMENT' sign in the background. Several people are standing near the booth, and there are white cylindrical containers in the foreground. A timestamp '17/10/2014 12:14' is visible in the bottom right corner.	<p>ZWC booth at IGEM 2014</p>
 A photograph showing a group of people visiting the ZWC booth. The booth is decorated with green and white panels and has a 'ENGAGEMENT' sign. A timestamp '17/10/2014 12:14' is visible in the bottom right corner.	<p>ZWC booth was visited by various people</p>
 A photograph of AP Dr Sumiani giving a presentation on ZWC. She is standing on a stage in front of a large screen displaying a presentation slide. The screen also shows the text 'GREEN INSIGHTS STAGE A' and 'CREATING GREEN WEALTH'. A timestamp '18/10/2014 10:30' is visible in the bottom right corner.	<p>AP Dr Sumiani was giving a talk on ZWC in one of the session</p>

Sub-section 2.3: Eco-conference in UMS

ZWC had presented a paper in the eco-conference organized by UMS (University Malaysia Sabah) in April 2014.

Figure 2.8: Eco-conference in UMS

 A photograph showing a woman in a blue patterned hijab and a light blue patterned dress standing at the front of a conference room, gesturing towards a presentation screen. The room has a large wooden conference table in the foreground and other attendees seated around it. A timestamp '2014/04/11 11:55' is visible in the bottom right corner of the photo.	<p>AP Dr Sumiani presented during the conference</p>
 Two side-by-side photographs. The left photo shows two women standing indoors; one is wearing a white blazer and the other an orange hijab and jacket. The right photo shows a man in a blue jacket and black pants kneeling on a grassy area, using a blue shovel to plant a small tree. A timestamp '2014/04/11 11:55' is visible in the bottom right corner of the right photo.	<p>Left: Dr Sumiani with reps from Japan</p> <p>Right: Jaron Keng planted a tree</p>
 A group photograph of approximately 20 people, mostly men, standing behind a large U-shaped wooden conference table in a well-lit room with wood-paneled walls.	<p>Group photo</p>

Sub-section 2.4: New composting site

In May of 2014, all the compost piles under the canopies were moved to the vacant land under TNB transmission line. This move is intended to enlarge the size of compost pile and increase the composting capacity. After one month, it was found that compost piles in open air are not being affected by rain.

Figure 2.9: Compost piles under TNB transmission line

	Compost piles
	One of the piles

Figure 2.10: Operation at new site

	<p>Transfer of food waste in wheelie bin</p>
	<p>Unloading of food waste into compost pile</p>
	<p>Turning of compost piles for aeration</p>

Sub-section 2.5: Collaboration with UMT on compost research

In May 2014, ZWC formed collaboration with UMT on research on compost microbiology characteristic and quality. Dr. Nizam from UMT visited to ZWC facility and took some samples for research.

Figure 2.11: Visit by UMT (University Malaysia Terengganu)

 A group of five people (three men and two women) are standing behind a round wooden table in an indoor setting. The man on the far left is wearing a light blue striped shirt. The woman next to him is wearing a green hijab and a patterned green and white dress. The man in the center is wearing a red batik shirt. The woman next to him is wearing a white shirt. The woman on the far right is wearing a black t-shirt with white text. The table in front of them has some papers and small containers on it.	Group photo
 A man in a white shirt (Jaron) is standing and pointing towards a large pile of dark, moist compost material. Another man in a red batik shirt (Dr. Nizam) is sitting on the ground, looking at a smartphone. The background shows some outdoor structures and foliage.	Jaron explained on the ZWC operation to Dr Nizam of UMT

Sub-section 2.6: Visitors to ZWC in year 2014

There are various visitors to ZWC facilities in the year of 2014 from academic, government, private sector, media and non-governmental organization. The notable visitors are listed as below:

Table 2.1: List of notable visitors to ZWC

No.	Visitor	Represent
1.	Germany-Malaysia Institute (GMI)	Academia
2.	Students from STS, Recycle12, AIESEC, UM	Academia
3.	Japanese students	Academia
4.	KeTTHA	Government
5.	MBPJ (Petaling Jaya City Council)	Government
6.	Greater Eco Melawati	NGO
7.	UTM (University Teknologi Malaysia)	Academia
8.	Denso	Private sector
9.	DOA (Dept. of Agricultural)	Government
10.	AKEPT	Academia
11.	Harian Metro	Media
12.	NTV 7	Media

In 2014, ZWC also organized visit to several places such as:

1. Life Life Clothing used clothes recycling factory
2. JPS (Dept. of Irrigation & Drainage) river treatment plant
3. UPM Bio-refinery complex

. Figure 2.12: Visitors from GMI and UM

	Visitors from GMI
	Visitors from Recycle12
	Explanation of e-waste collection

Figure 2.13: Visitors from UM



Visitors from AIESEC



Visitors from STS



Visitors from STS

Figure 2.14: Visitors from Japan & KeTTHA



Visitors from



Visitors from Japan



Visitors from KeTTHA

Figure 2.15: Visitors from MBPJ & Eco Melawati

	Visitors from MBPJ
	Explanation of composting method
	Visitors from Eco Melawati

Figure 2.16: Visitors from UTM, Denso & DOA



Visitors from UTM



Visitors from Denso



Visitors from DOA

Figure 2.17: Visitors from AKEPT and Harian Metro



Visitors from Akept



Visitors from DOA



Reporter of Harian Metro

Figure 2.18: Interview by NTV 7

 A photograph showing a woman in a light blue hijab and patterned dress (AP Dr Sumiani) being interviewed by a woman in a purple hijab and white shirt (NTV7 reporter). They are standing under a white tarp in an outdoor setting. A timestamp '05/12/2014 15:42' is visible in the bottom right corner of the image.	<p>AP Dr Sumiani was interviewed by NTV7 reporter</p>
 A photograph showing a man in a white shirt and blue jeans standing next to a green structure, possibly a water pump or well. A woman in a yellow safety vest and red shirt is also visible. A timestamp '05/12/2014 15:43' is visible in the bottom right corner of the image.	<p>Video shooting</p>
 A photograph showing a woman in a light blue hijab and patterned dress (AP Dr Sumiani) being interviewed by a woman in a purple hijab and white shirt (NTV7 reporter). A man in a white shirt and blue jeans is also visible, standing next to a camera on a tripod. A timestamp '05/12/2014 15:54' is visible in the bottom right corner of the image.	<p>Video shooting</p>

Figure 2.19: Visit to JPS river water treatment plant at Ampang



AP Dr Sumiani with JPS officers



JPS river water treatment plant at Ampang



Briefing by JPS officer

Figure 2.20: Visit to UPM bio-refinery complex (1)

 A photograph showing two people, a man in a light-colored shirt and a woman in a blue patterned hijab, walking on a paved path. To their right is a large pile of brown organic material, likely compost or wood chips, under a large metal-roofed structure. The background shows some greenery and a building. A timestamp '28/05/2014 11:54' is visible in the bottom right corner of the photo.	<p>AP Dr Sumiani with Prof. Ali Hassan at the center</p>
 A photograph of a yellow Brackhus compost turner machine. The machine has a large horizontal rotating drum and green discharge chutes. A person's arm is visible on the left, pointing towards the machine. The machine is parked on a concrete surface. A timestamp '29/05/2014 11:40' is visible in the bottom right corner of the photo.	<p>Brackhus compost turner</p>
 A photograph of a wood waste pyrolysis system. It features a large, dark, rectangular processing unit with a metal frame and a crane hook above it. A person is standing near the unit. The system is located outdoors under a large metal-roofed structure. A timestamp '29/05/2014 12:11' is visible in the bottom right corner of the photo.	<p>Wood waste pyrolysis system</p>

Figure 2.21: Visit to UPM bio-refinery complex (2)



Briefing by UPM staff



Token of appreciation to Prof. Ali Hassan



Group photo

Sub-section 2.7: Wood waste separate collection for energy recovery

At the end of 2014, ZWC had initiated a separate wood waste collection system for energy recovery in collaboration with JPPHB and TSP Waste Management Sdn Bhd. Wood waste such as tree trunks, tree branches and discarded wooden furniture are loaded separately into several open top Ro-Ro bins dedicated for wood waste only. The wood waste is sent to a paper mill in Rawang as alternative fuel for boiler.

Figure 2.22: Wood waste separate collection (1)

	<p>Open top Ro-Ro bins dedicated for wood waste</p>
	<p>Old wooden furniture in the bin</p>

Figure 2.23: Wood waste separate collection (2)

	<p>Another view</p>
	<p>Tree trunks and tree branches</p>
	<p>Pick-up of bin by TSP Waste</p>

Sub-section 2.8: ZWC's appearances in local media

ZWC had several appearances in the local media such as:

1. Harian Metro: 31st October 2014
2. Utusan: 7th December 2014
3. Astro Awani : 9th December 2014
4. Astro Awani : 7th December 2014



ZWC-UM pulihara alam sekitar

KUALA LUMPUR 6 Dis. - Sisa pepejal perlu diurus secara bersepadu, holistik dan mampan agar dapat dijadikan sumber tenaga yang boleh diperbaharui, bukannya gas atau toksik yang mencemarkan alam sekitar.

Menurut Ketua Penyelaras Rempen Sisa (ZWC) Universiti Malaysia (UM), Profesor Madya Dr. Sumiani Yusoff, sistem pengurusan sisa pepejal yang melonggokkan dan mencampurkan segala bentuk bahan buangan ke tapak pelupusan sampah perlu segera dihindarkan atau paling tidak diminimumkan.

"Statistik menunjukkan 45 peratus daripada 33,000 tan sisa pepejal yang dibuang setiap hari adalah sisa makanan. Apabila sisa makanan ini dilupuskan di tapak pelupusan sampah bersama bahan organik

lain, ia akan menyebabkan penghasilan gas rumah hijau metana, malah satu punca yang menyumbang kepada pemanasan global.

"Lebih buruk lagi, di tapak pelupusan yang tidak mengamalkan prinsip kejuruteraan, sisa organik itu akan mengurai dan membentuk air kurasan (leachate) yang boleh mencemari air sungai dan air bawah tanah dengan pelbagai bahan pencemar termasuklah bahan cemar logam berat. Nanti-hanya air tercemar ini juga akan memasuki sistem saluran sungai yang kemudiannya diproses untuk bekalan air minuman kita," katanya ketika ditemui di pejabatnya baru-baru ini.

Sebagai satu usaha untuk menangani pengurusan sisa pepejal dan jalan penyelesaian praktikal, UM telah melancarkan satu kempen ZWC pada November 2010

- satu kempen pengurusan sisa pepejal secara bersepadu yang mengamalkan pengurangan sisa di peringkat sumber, menghasilkan baja kompos daripada sisa makanan dan sisa organik.

Menurut kempen ZWC ini, UM berjaya mengurangkan dan mengitar semula 15 peratus bersamaan 30 tan sebulan sisa organik daripada dibuang ke tapak pelupusan sampah. Sisa organik ini diproses secara semula jadi menjadi baja kompos dan secara anaerobik menggunakan mesin penguraian kepada biogas serta baja cecair.

"Bagi memastikan kelestarian kempen kitar semula, mekanisme dan kemudahan infrastruktur perlu sedia pengurusan, dipantau secara berterusan, di samping memupuk kesedaran melalui latihan serta pendidikan.

Paling penting, kata Sumiani, adalah data sisa dan proses kitaran semula yang dikumpulkan dalam kempen ZWC ini menjadi asas untuk penambahbaikan, pemantauan dan pemuliharaan kepada sistem pengurusan sisa pepejal bersepadu yang lebih berkesan pada masa depan.

"Dalam konteks ini, UM juga telah dipilih sebagai salah satu projek rintis di bawah Kerangka Rangka Ronda Karbon Kementerian Tenaga, Teknologi Hijau dan Air," katanya.

Menurut ZWC, UM membuktikan pengurusan sisa pepejal secara bersepadu dan menyeluruh boleh dilaksanakan malah memberi impak positif dari segi sosial, ekonomi dan pemuliharaan alam sekitar.



SUMIANI YUSOFF (kiri) sambil dibantu oleh seorang kakitangannya mengerjakan kaedah pengiraan sisa pepejal bagi menghasilkan baja kompos yang diperkualiti melalui kempen ZWC.

Di Malaysia, setiap hari 33,000 tan sisa pepejal dibuang ke tapak pelupusan sampah, dan jumlah ini boleh memenuhi Menara Berkembar Petronas dalam masa tujuh hari

Utusan 7th Dec 2014



Astro Awani 8th Dec 2014

Sub-section 2.9: E-waste “bring” drop-off collection

In 2014, two (2) collection of e-waste had been carried out in March and Oct 2014. About 800kg of e-waste had been collected through the two (2) units of 660L wheelie bins at ZWC site. More efforts are needed to promote e-waste separate collection among communities in UM campus and to provide the necessary facility for collection.

Figure 2.24: Two (2) e-waste drop-off 660L wheelie bins

 A photograph showing two green 660L wheelie bins with their lids open, parked outdoors. The bins have white labels with a recycling symbol and text. A small green cross symbol is visible on the wall behind them.	<p><i>Two (2) e-waste drop-off 660L wheelie bins at ZWC site</i></p>
 A close-up photograph of the interior of a green wheelie bin, showing various electronic waste items including a laptop, a power supply unit, and other components. A timestamp '12/05/2014 10:15' is visible in the bottom right corner of the image.	<p>E-waste collected</p>

Figure 2.25: E-waste collection



Weighing of e-waste



Collection of e-waste by T-POT
Electric and Electrical

T-POT T-POT Computer Site Visit version
No. 01-01-001 (Version 1.0) T-POT Computer Site Visit version
Version 1.0, 2019.12.10. (T-POT Computer Site Visit version)
No. 01-01-001 (Version 1.0) T-POT Computer Site Visit version
No. 01-01-001 (Version 1.0) T-POT Computer Site Visit version

WASTE COLLECTION SHEET (WCS)

Company Name: ABC Co., Ltd. WCS No: 53972

Date & Time: 2020/07/14 Purchase Number No:

No.	ITEM	QUANTITY / UNIT	TOTAL	UNIT / PCS
1	Monitor	1	1	1
2	Mouse	1	1	1
3	Keyboard	1	1	1
4	Power supply	1	1	1
5	Hard drive	1	1	1
6	SSD	1	1	1
7	RAM	1	1	1
8	Motherboard	1	1	1
9	Case	1	1	1
10	Power cord	1	1	1
11	USB cable	1	1	1
12	Network cable	1	1	1
13	Printer	1	1	1
14	Scanner	1	1	1
15	Other	1	1	1
16	Other	1	1	1
17	Other	1	1	1
18	Other	1	1	1
19	Other	1	1	1
20	Other	1	1	1
21	Other	1	1	1
22	Other	1	1	1
23	Other	1	1	1
24	Other	1	1	1
25	Other	1	1	1
26	Other	1	1	1
27	Other	1	1	1
28	Other	1	1	1
29	Other	1	1	1
30	Other	1	1	1

COLLECTED BY: T-POT (Signature)
Name: T-POT
Date: 2020/07/14

CONFIRMED BY: (Signature)
Name: (Signature)
Date: 2020/07/14

RECEIVED BY: (Signature)
Name: (Signature)

Data of e-waste collected

Section 3: Challenges and way forward

Sub-section 3.1: Waste and recycling data collection

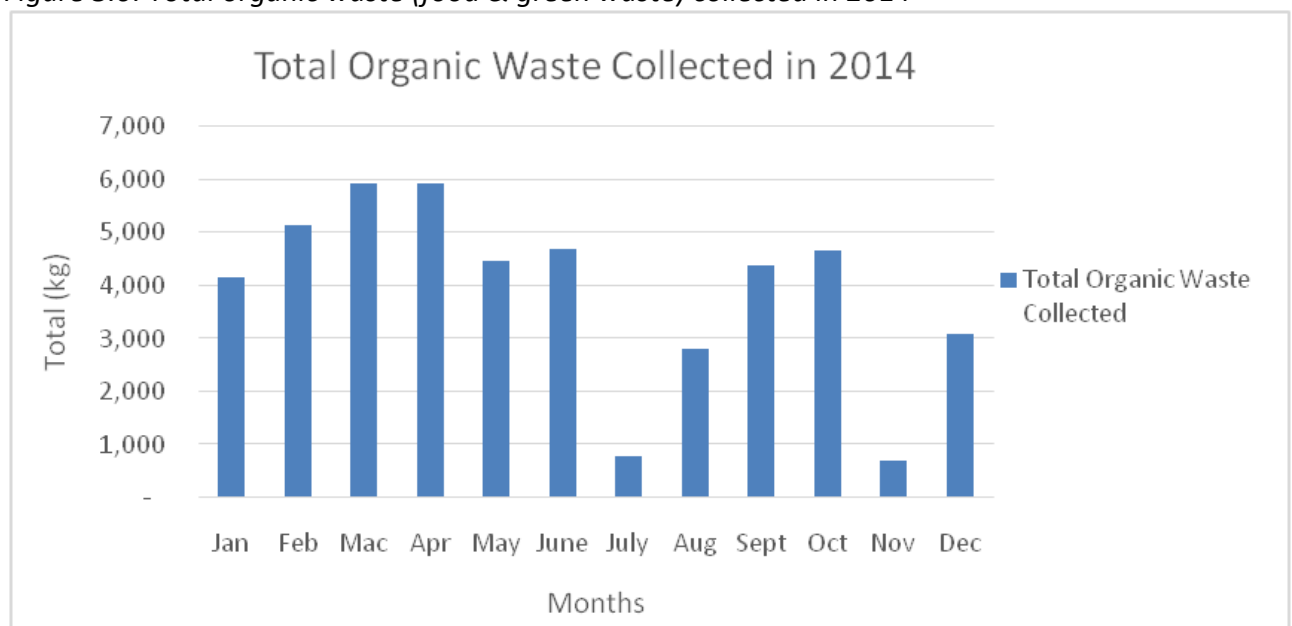
Data collection and analysis is very important in development of integrated waste management plan. For UM, JPPHB has began to collect waste disposal data in tonnage per trip for the private waste contractor appointed by UM. However, JPPHB hasn't provided ZWC the full waste disposal data in 2014. For ZWC, the complete /comprehensive data that ZWC fully possesses are as below:

1. Food waste collected for composting or anaerobic digestion
2. Green waste collected for composting
3. Wood waste collected for energy recovery
4. Waste textiles collected for reuse/recycle
5. E-waste collected at ZWC site for recycling/recovery

Other waste data that received by ZWC are as follow:

1. General (residual) waste disposed to landfills by private contractor - Provided by JPPHB
2. E-waste (with tagging) collected by JPPHB – Provided by JPPHB
3. Scrap metals - Provided by JPPHB
4. Clinical waste - Provided by UKKP (safety, health & environment unit)
5. Used cooking oil - Provided by Kris Biofuel Sdn Bhd

Figure 3.0: Total organic waste (food & green waste) collected in 2014



Note: Organic waste in the above graph doesn't include wood waste (the inclusion of wood waste as organic waste is not yet ready for 2014)

Figure 3.1: Total food waste composted in 2014



Figure 3.2: Total food waste digested in 2014



Figure 3.3: Total green waste composted in 2014

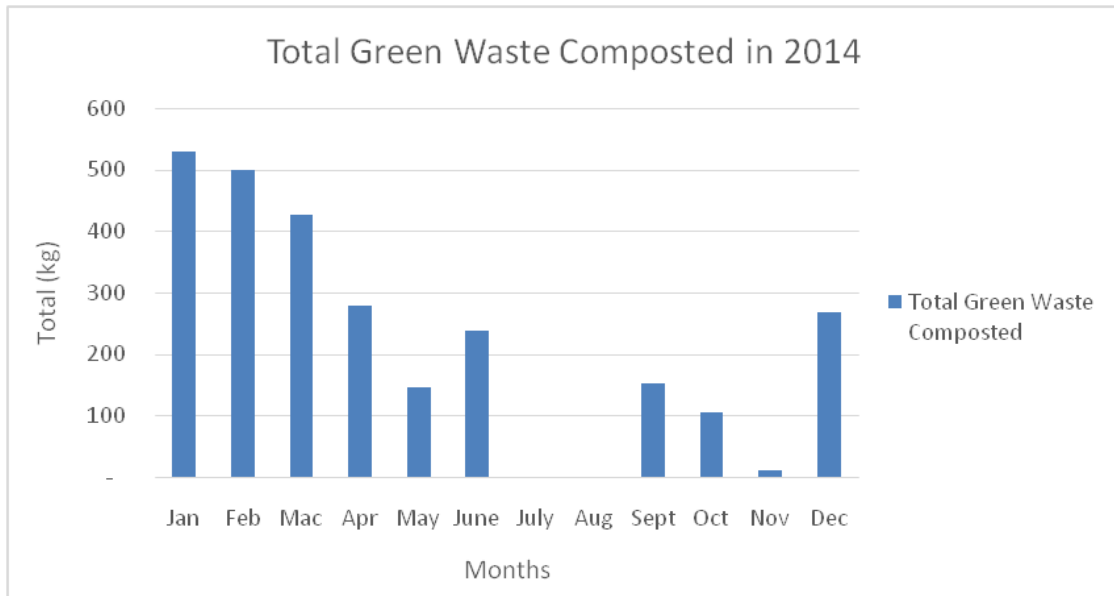


Figure 3.4: Total compost output in 2014

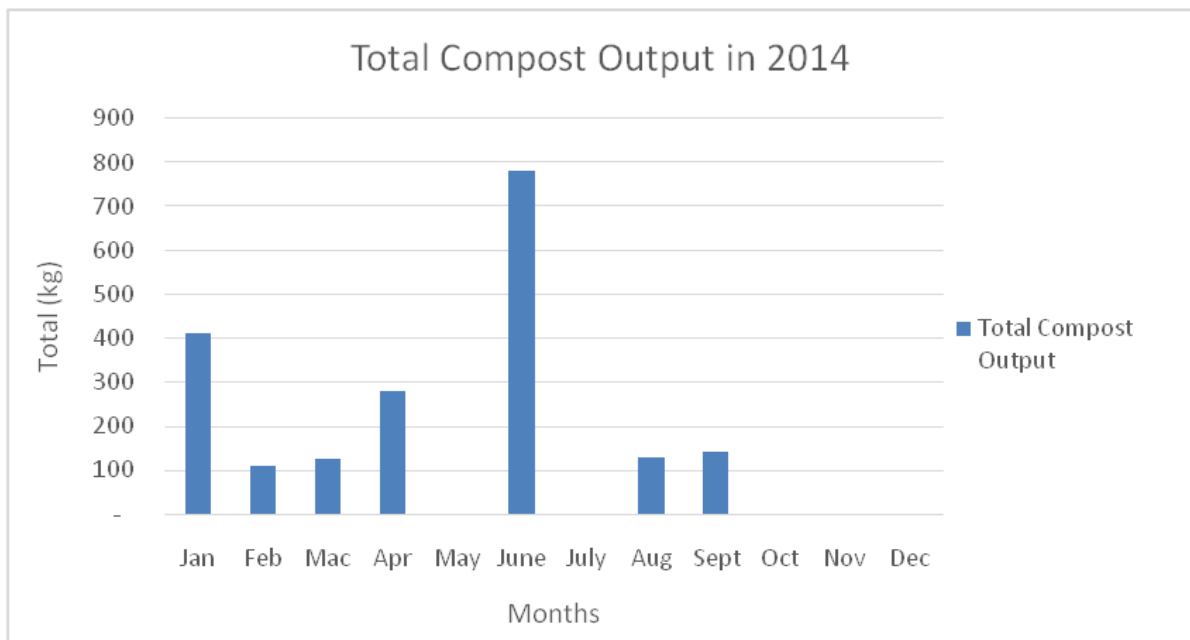


Figure 3.5: Total wood waste collected in 2014

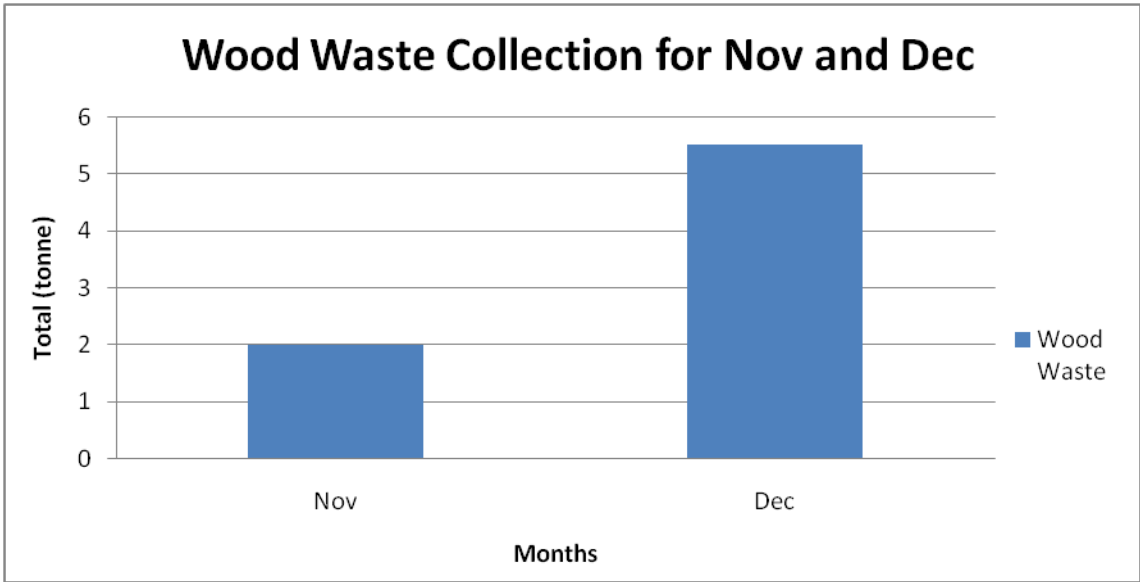


Figure 3.6: Total wood waste collected in 2014 by percentage

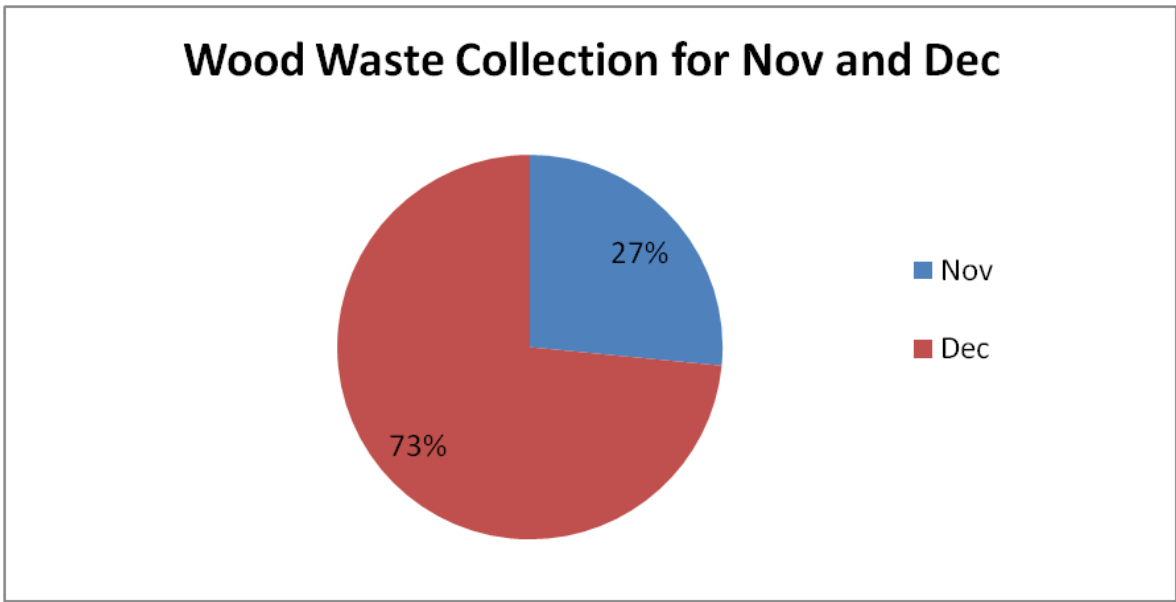


Figure 3.7: Total organic waste treatment in 2014

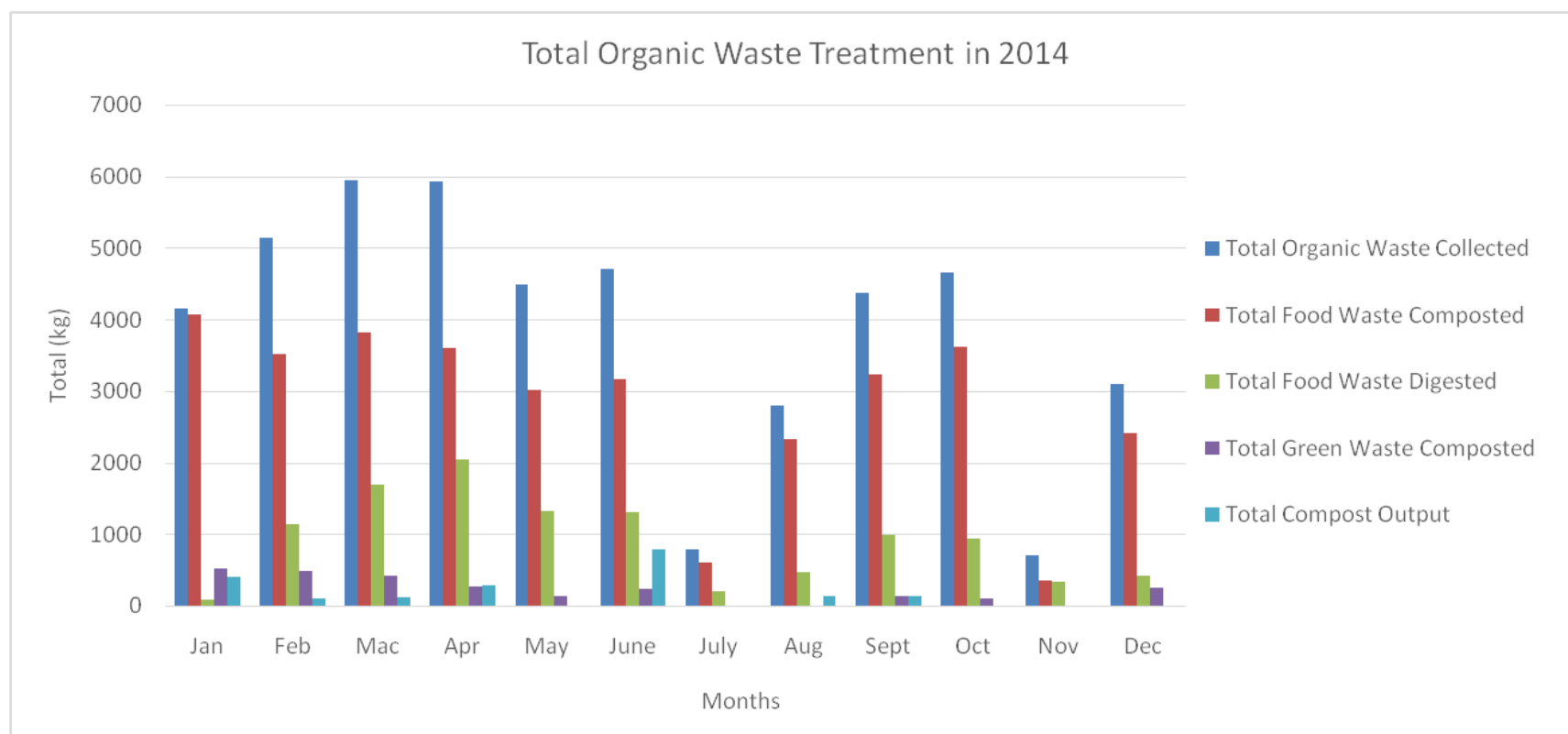


Figure 3.8: Total organic waste treatment from 2011 until 2014

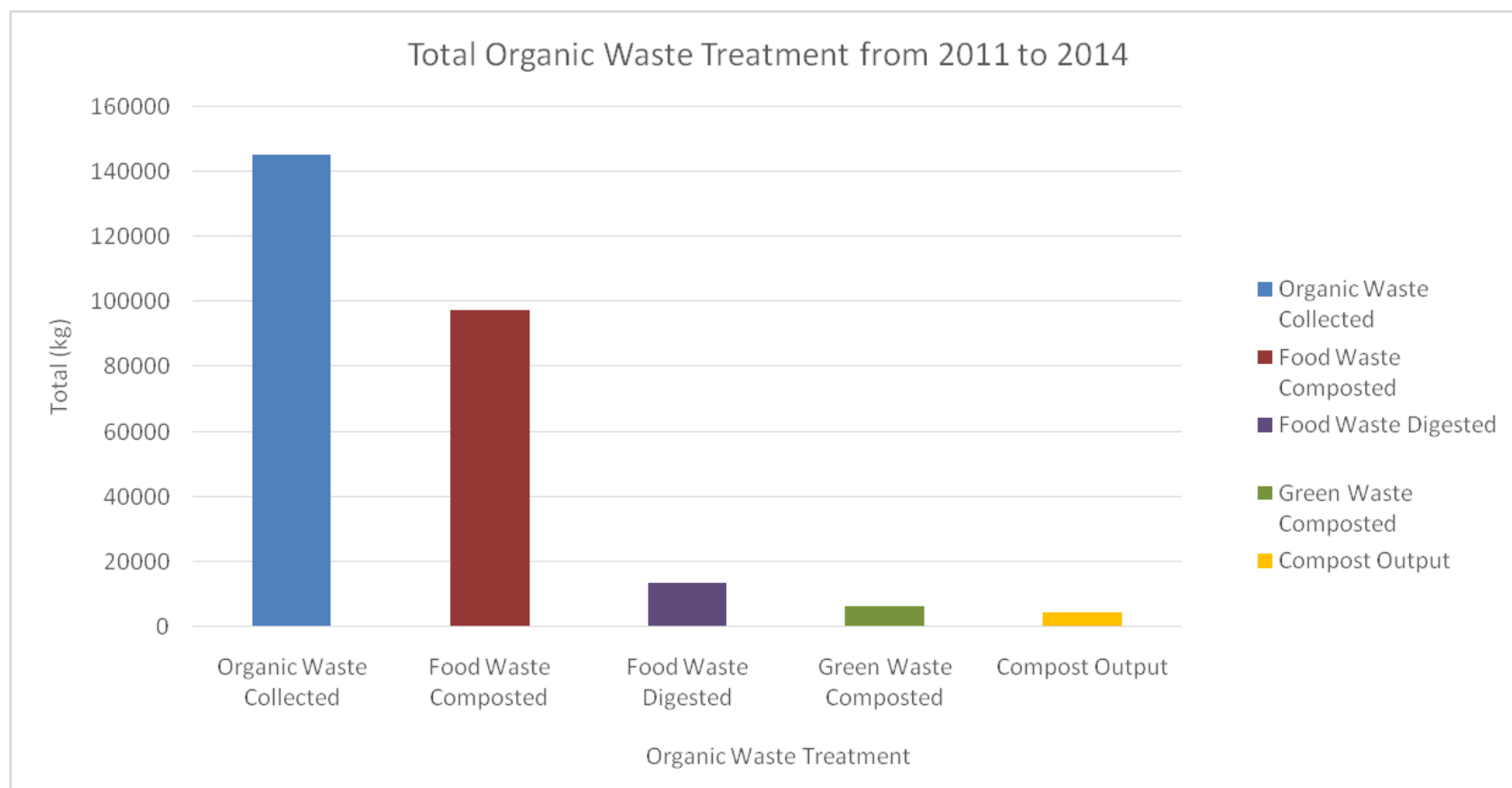


Figure 3.9: Total used clothes collected in 2014

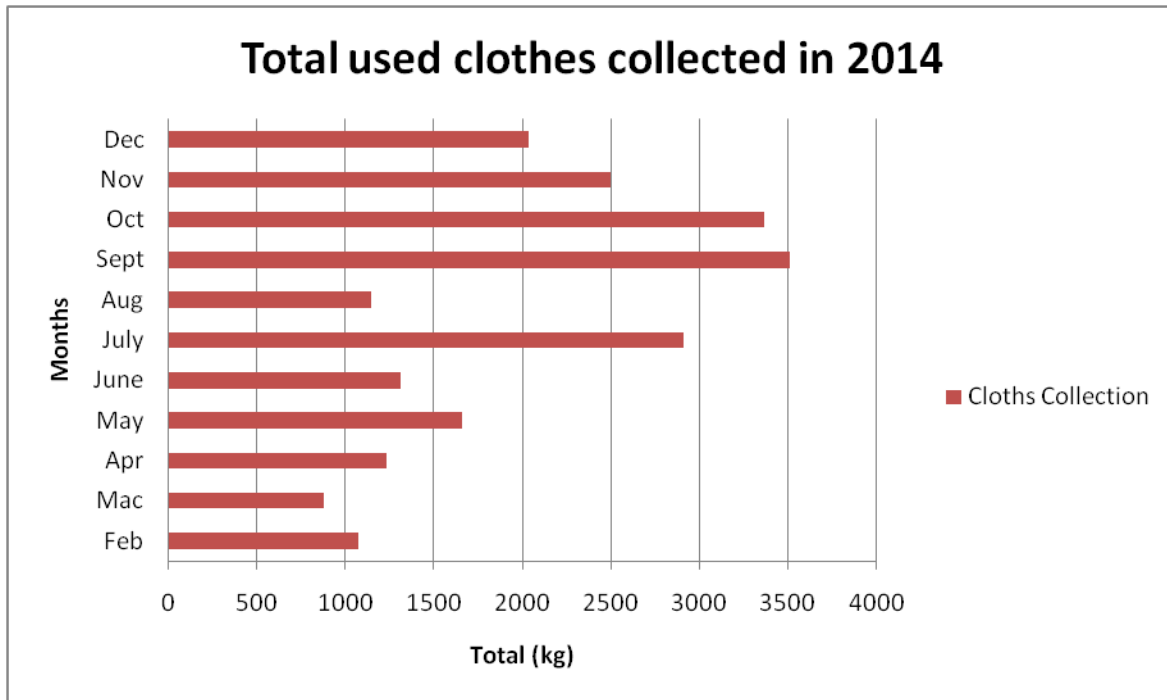
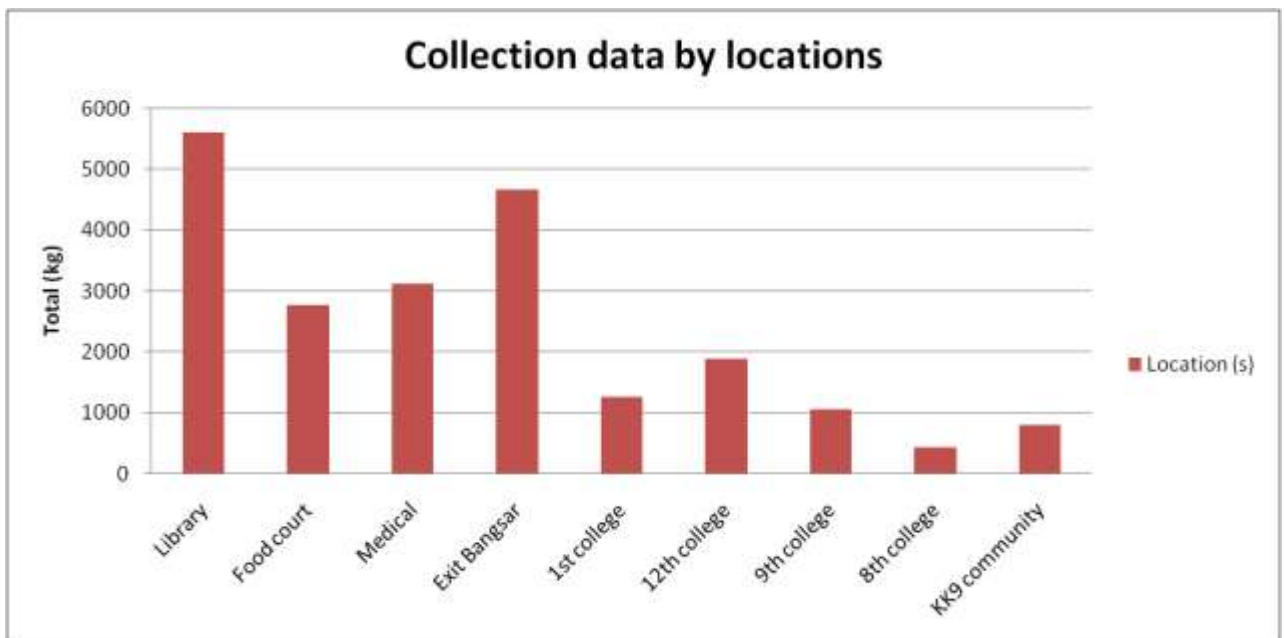


Figure 3.10: Total used clothes collected in 2014 by locations



Sub-section 3.3: Challenges and proposed projects in 2015

The biggest challenge that faced by ZWC presently is the informal recycling collection activities which hinder the systematic development of separate collection of recyclables and recycling data collection. Without recycling data, it is not possible to analyze recycling rate and carry out planning for further improvement.

Besides recycling data, general waste disposal data collection is still not fully established especially the waste collected by Alam Flora sub-con. Construction & demolition (C&D) waste is another waste stream that is totally out of control, as normally building contractors have their own open top bins or hire their own waste contractor and disposed the C&D waste at illegal dumpsites.

The other challenges, most related to food waste segregation, are elaborated as below:

Challenge #1: Green Bag Scheme

- TNC(P) and JPPHB will supply 24,000 pcs of white bags to all cafeteria operators
- They also purchase 50 sets of OR-Bin and 5 sets of recycle bins
- However, most important is there is a mechanism to ensure the café operators practice food waste segregation (policy, regulations, monitoring and enforcement)
- ZWC will plays the role to monitor. However, the first step of policy and regulation introduction and implementation is critical ...
- One of the issue is there is *NO existing national/local legislation on mandatory food waste segregation at source..* UM has to take the initiative.

Challenge #2 – Food waste sorting

1. Current kitchen waste “**Manual**” sorting is not a desirable method (**30% impurities in kitchen waste**)
2. Food waste segregation at source has to be enforced with Green Bag Scheme!
3. Even so, 100% purity is not possible, kitchen waste in “green bag” still got impurities (paper & plastic)
4. In a medium term (5-10 years), **food waste mechanical sorting machine** can be a feasible solution (such as Trommel screen)

Challenge #3 – Compost quality

1. ZWC realize the compost produced all this while is not fully matured, as we found that the fully matured compost under the compost piles is black in color with earth smell
2. ZWC is working to improve the composting process with ancillary microbes and enzyme to expedite the composting maturity period; such as adding the digestate from Cowtec AD into composting piles
3. ZWC is collaborating with UMT, Dr Nizam on compost microbiology study since April 2014

Challenge #4 – Treatment capacity increment

1. To increase composting capacity to > 20 ton/month with **green waste shredding and windrow composting**
2. Food waste gradually diverted to anaerobic digestion (currently the Cowtec AD is fully utilized: 100kg/day) – **ACHIEVED**
3. Shift the composting facility to the 0.15 acre land beside UM Alumni club house / land under TNB transmission line
4. Project development pending from initiative from TNC(P) due to the **huge budget incur – SHREDDER & WHEEL LOADER**

Challenge #5: Waste data collection

1. Need collaboration from JPPHB for domestic waste and green waste data
2. PTj has to cooperate to hire contractors (for construction and renovation waste) that send their waste to authorized landfill to obtain weighbridge ticket
3. Data is important for continual improvement

Section 4: Conclusion

2014 marked a significant year for ZWC, especially in recycle of more waste streams with public private partnership and research collaboration. The separate collection of non-valuable waste streams (wood waste, waste textiles, green waste and food waste) for reuse/recycle/recovery by ZWC is a strategic trajectory to gradually institutionalize the informal recycling collection for recyclables with commercial values such as paper, plastic and metal. More research activities and collaborations are anticipated in the next few years. Larger scale, semi-mechanized composting method is also the next important action plan in 2015.

Appendix A: Photos of ZWC facilities and activities

 A photograph showing several large, dark brown piles of compost material arranged in a row in an open field. The background features green trees and a clear sky. A timestamp in the bottom right corner reads "17/06/2014 10:25".	<p>New composting site with aerated static piles method</p>
 A photograph of a green metal structure, likely an anaerobic digester, enclosed by a chain-link fence. The structure has a brown wooden roof and a set of stairs leading up to it. A timestamp in the bottom right corner reads "17/06/2014 12:41".	<p>Cowtec[®] anaerobic digestion</p>
 A photograph of a green waste shredder machine. The machine is green with a black engine and a large hopper for waste. It is parked on a concrete surface. A broom is leaning against it. A timestamp in the bottom right corner reads "17/06/2014 12:41".	<p>Green waste shredder Left: Electricity powered Right: Petrol/biogas powered</p>



Example of a refuse room at a faculty



Example of recyclables collected by janitor at a faculty (informal recycling collection)



Closer look at the recyclables, mostly papers and plastics



Recycle bin



Recycle bin given to KK8



1-ton electronic weighing scale machine



Grinded compost



Compost packed in 0.5kg pack





Recycling
collection by
ZWC



Recyclables
collected by
ZWC





View of ZWC facility in 2014



Video shooting by PPSPPA



Visited by JPPPHB, En Aziz and En Mustafa



Visited by
students from
KK7



Turning of
compost piles



Cooking using
biogas