Solid Waste Generation in the University of Technology

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Abstract

The aim of this research is to study the ability of solid waste utilization in the University of Technology due to large amount of waste produced which could be considered as a natural resource for the country.

The research continued for six month , number of samples were 2520 from all department in the university .After collection samples were separated by hand to paper, metal, plastic , organic food, wood, glass and other.

The Result revealed the variation of solid waste components with the domination of paper. Organic matter which constituted 18.66% could be used to produce soil conditioners. Recycled and reused matters comprised11.7% could also be advantageously used .The remaining which amounted 24% could be sent to landfill.

Monthly calculations for production rates of solid waste from each department of the university the highest production the Wlthural Electronical Servies 171.7 Kg/day in March 2013.

Solid waste results compared with the waste produced from other universities, University of Technology was the large amount of solid waste production.

Statistical analyses were done to represent the scatter of each component about the mean value.

Keywords : Solid Waste, Composition, Landfill

تولد النفايات الصلبة في الجامعة التكنولوجية

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الخلاصة

انتشار حاويا ت المخلفات الصلبة إمام أقسام الجامعة التكنولوجية وما تشكله المخلفات الصلبة من ثروة طبيعية للبلد تطلب إجراء هذا البحث حيث تم لمدة ستة اشهر جمع نماذج المخلفات الصلبة التي بلغت 2520 نموذج من كافة أقسام الجامعة .تم تصنيف هذه المخلفات بواسطة اليد الى الورق، المعادن، الزجاج ،المواد الغذائية ،الخشب،البلاستيك ،وأشياء أخرى .

أظهرت النتائج وجود فروق بين تركيبة مكونات الصلبة مع هيمنة الورق على باقي المكونات يلغت نسبة الفضلات الغذائية والنفايات العضوية 18.66 % والتي يمكن استخدامها في إنتاج مواد دبالية او مكيفات للتربة كما بلغت نسبة المواد التي يمكن تدويرها او استخدامها 11.7 % مما يدع الجزء الباقي يدفن في مواقع الطمر الصحي 24 %.

تم حساب معدل الإنتاج الشهري للنفايات الصلبة لكل قسم من أقسام الجامعة وقد بلغت أعلى إنتاجية 171.7 كغم /يوم في قسم خدمات الثقافية الالكترونية في شهر آذار.

تم إجراء مقارنة بين مخلفات النفايات الصلبة للجامعة مع ثلاث جامعات أجنبية ووجد ان الجامعة أكثر إنتاجا للنفايات.تم إجراء التحليل الإحصائي لنتائج مكونات النفايات الصلبة والتي اثبت تباين النتائج وتشتتها عن المعدل الحسابي.

الكلمات الدالة : النفايات الصلبة ،تركيبة النفايات، الدفن

Introduction

Solid wastes are defined as those wastes from and animal activities. In the domestic environment the solid wastes include paper, plastics, food wastes, ash, etc. Also included are "liquid wastes" including paints, old medicines, spent oils etc .Commercially, paper packagings, timber and plastic containers make up the bulk .Improper management of solid wastes has direct adverse effects on health. The uncontrolled fermentation of garbage creates a food source and habitat for bacterial growth. In the same environment, insects, rodents and some bird species (seagulls) proliferate and act as passive vectors in the transmission of some infectious diseases. [1]

In recent years, awareness and concern about solid waste issues have increased. This growing public consciousness has been fueled by the three-part crisis of waste osal: Contamination, capacity and cost. As evidence mounts about the environmental and public health impacts associated with reaching landfills and improperly designed incinerators, it has become increasingly difficult to site ewilities. The relative scarcity of disposal facilities, along with increasing environmental controls, has forced waste disposal costs up. In fact, waste disposal is the most rapidly growing line item of many municipal and institutional budgets. Solid waste has also emerged as a visible and tangible symbol of our consumptive society, and strategies to address solid waste are often the first line of action for those seeking to reverse trends of deteriorating environmental conditions.The operations of universities and colleges are similar in many ways to those other sectors ofsociety. Universities feed and house people, conduct research, heat offices, run athletic facilities, and maintain grounds. In that process they use large amounts of resources and generate waste. As teaching institutions, universities are particularly important targets for source reduction efforts. If they can teach by setting an example within their own walls, the benefits will be multiplied as students apply the lessons learned to their professional and personal lives. [2]

Public Health Aspects of Solid Waste Management

Solid wastes may contain:

- Human pathogens – diapers , handkerchiefs , contaminated food and surgical dressings
- Animal pathogens – waste from pets
- Soil persons – garden waste

Inadequate storage of such wastes provides breeding ground for vermin, flies, cockroaches and birds (seagulls), which may act as passive vectors in disease transmission. The general public, but more particularly the solid waste employees, are at risk. The pathogens that can cause faecal-related disease are show in Table (1). The pathogens include viruses, bacteria, protozoa and helminthes.

For a person to be at risk from solid waste pathogens suitable conditions must exist and these are:

1. An infectious dose of the pathogen must be present.
2. There must be transmission route of the pathogens to the person, i.e. aerosol, faecal –route , hand to mouth , etc.
3. The person must have no immunity to the pathogen.

Table .(1) Viral, bacteria and protozoal pathogens in faecal contaminated solid waste [3]

pathogens	Organism	Disease	Reservoir
Viruses	Poliovirus	Poliovirus	Man
	Hepatitis A	Hepatitis A	Man
	Hepatitis B	Hepatitis B	Man
Bacteria	Campylobacterfetus sp.	Diarrhoea	Animals and man
	Pathogenic E. coli	Diarrhoea	Man
	Slamonella S. typhi	Typhoid fever	Man
	Slamonella S.Paratyphi	Paratyphoid fever	Man
	Other Salmonella	Food poisoning	Animals and man
	Shingella spp.	Bacillary dysentery	Man
	Vibrio c	Cholera	Man
	Other Vibrio	Diarrhoea	Man
	Yersinia enterocolitica	Diarrhoea	Animals and man
Protozoa	Balantidium coli	Diarrhoea ,dysentery, colonic unlceration	Man, pigs and rats
	Entamoeba histolytica	Colonic ulceration, amoebic dysentery, liver abscess	Man, pigs and rats
	Giardia lamblia	Diarrhoea and malabsororption	Man and animals
Helminthes	Flat worms Round worms Tape worms Trematodes	Digestive disorders	Man and animals

Environmental Aspect of Solid Waste

Solid waste treatment and disposal methodologies are fraught with problems. Landfill sites, and dump sites in particular, because soil and groundwater contamination if not properly operated. Additional environmental problems with landfill are odours, litter, scavengers, fires, and rat infestation. Waste incineration has had problem with odours and air pollution. Composting has had difficulties with odours, heavy metals and slow compost sales. Transportation problems are associated with hazardous wastes. Health and hygiene are issues for waste operators. Municipal solid wastes and sludges have been problematic. Liquid-solid sluges applied to landfill have proved very difficult to handle. Land filling in climates like Ireland produces large quantities of leach ate which are toxic and of high organic strength and require treatment in wastewater plants. Land filling in dry climates produces localized air pollution problems. The record shows that landfill ,even thought still by far the most common disposal route , is undesirable and alternative must be pursued .[4]

Requirements for Source Separation

Source separation provides the cleanest and most well –defined fraction of waste suitable for subsequent recycling or reuse (but has the collected cost). Mechanicals or manual sorting (at destination) tends to provide fractions that may be comprised of more than one group. There are health hazards associated with manual sorting. Mechanical works best if there is a limited number of fractions that have well-defined physicals (e.g. density). Source separated wastes may be either collected at the doorstep or kerbside or delivered to a drop –off center. In practice, it is a combination of collection / delivery services that are used. For source separation to work, the following infrastructure is required:

1. Community drop –off centres for glass and non ferrous metals.
2. Public drop –off centres , often called civic amenity centres ,several different “skip” containers are containers are labeled for the reception of individual wastes
3. Environmental advertising programmers to firstly educate the public the required degree of source separation. In the first instance this may mean separating :

   Food

   Paper –newsprint

   -cardboard

   Plastic – seven type

   Metal –tin cars

   -others

Figure(1) is a schematic of a domestic facilitity for source separation. The level and type of source separation will depend on people’s attitudes and the end use. Ideally, the paper, glass and non ferrous metals could be recycled. The remained may only need to be separated into combustibles and non combustibles if the treatment process is incineration. If the food

fraction is to be transformed to biogas and compost, then the food fraction must be separated from the plastics and other non-biodegradable fractions. [5]

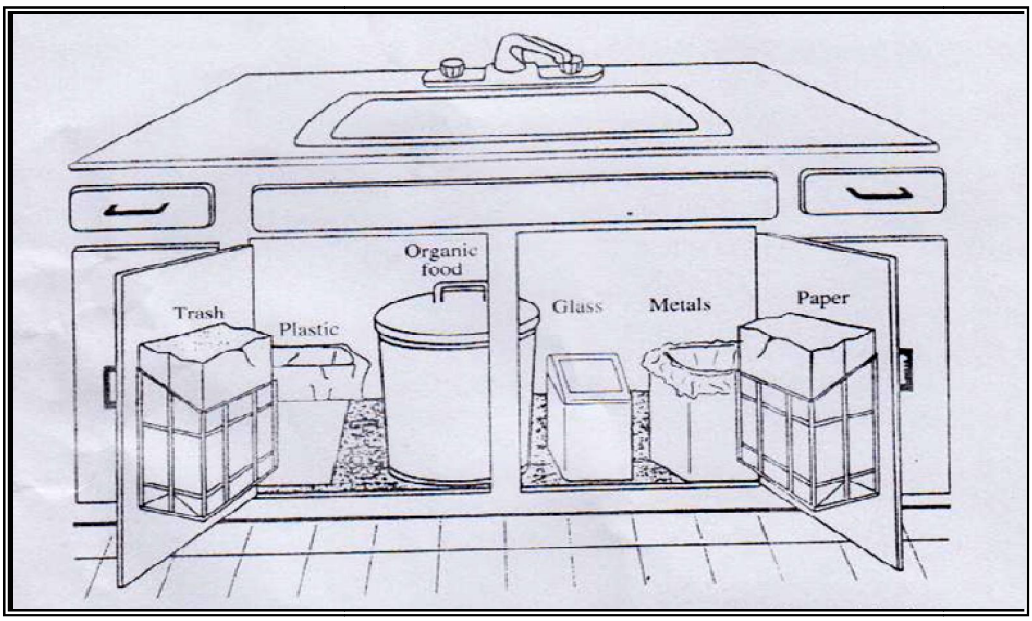

Fig .(1) is a schematic of a domestic facilitity

Field Work

Samples have been collected from departments of the University of Technology for Six months, two visits monthly. Samples were separated by hand and weighted using sensitive balance.

Solid waste can be classified in to seven types:

1. Paper: Contains all paper types, Cartons, newspaper, magazines, etc.
2. Organic food :Material capable of being decomposed by microorganisms with sufficient rapidity as to cause nuisances from odors and ;putrescribles(such as food preparation waste, spoiled food, kitchen waste, food scraps included here consist of uneaten food and food preparation scrapes from residences, and food restaurants.
3. Metal: Contains all types of metal ,tin can, pipes, metals scraps, furniture.
4. Wood: Contains parts of furniture, Seating, panicles, etc.
5. Plastic: Contains plastic bags, cups, plastic bottles, pens ,plates , tennis ball containers.
6. Glass: All types of glass, primary sours was glass bottles and discarded laboratory glass, windows glass, plate glass.
7. Other: Other waste typically includes; textiles, rubber and leather, computer equipment, latex pent, garage door openers, mercury switches, lamps, vacuum cleaners, radioactive and toxic chemicals.

Data Collected has been expressed in figures and compared with other data from international universities in order to know the different solid waste production and also to know its converging from its mean limits.

Results and Discussion

Results obtained are represented in Figures (2-7) represent the percentages of different solid waste components for every month in the university. Paper was the higher percent from other wastes because of the continence using by student students and officials. Percents for through months of the study were, paper (28%,32%,27%,31%,31%,30%),other waste organic food(14%,14%,16%,17%,19%,32%),metal(6%,5%,11%,9%,2%,2%),plastic(7%,5%,6%,5%,2%,2%),wood(6%,11%,4%,4%,4%,2%),glass(16%,7%,12%,16%,12%,17%)andother(23%,26% ,24%,18%,30%,23%).

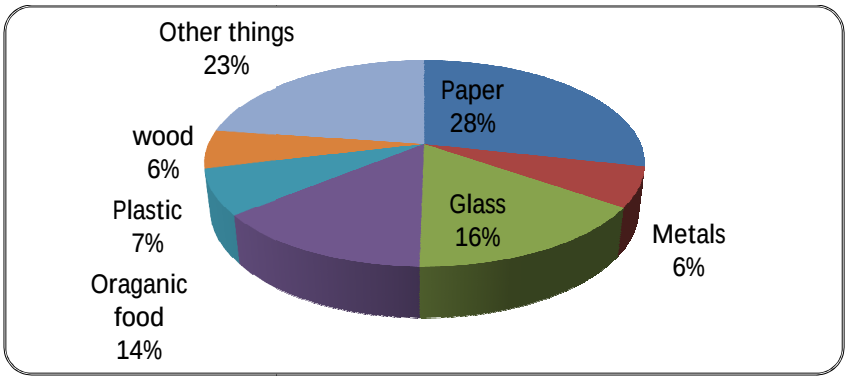

Fig .(2) Percentages of the types of solid waste for October 2012

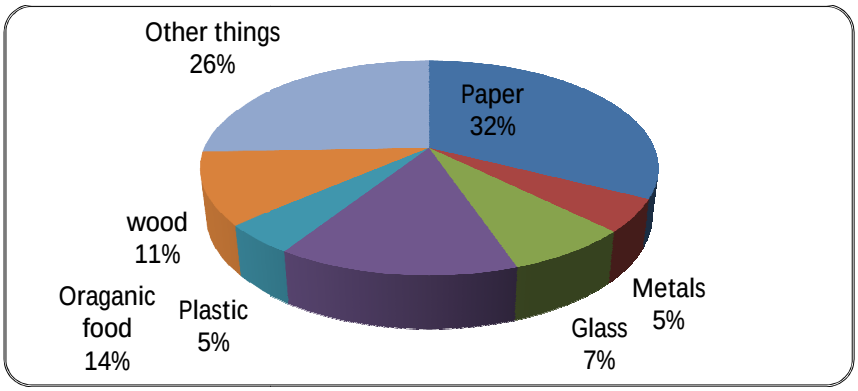

Fig .(3) Percentages of the types of solid waste for November 2012

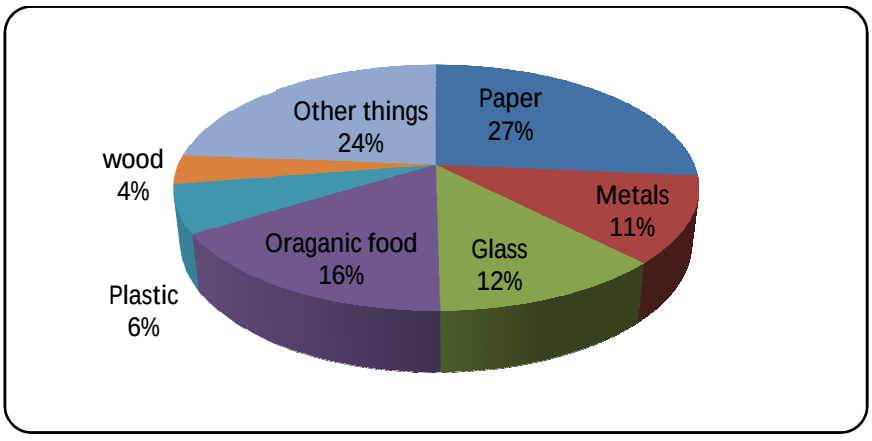

Fig .(4) Percentages of the types of solid waste for December 2012

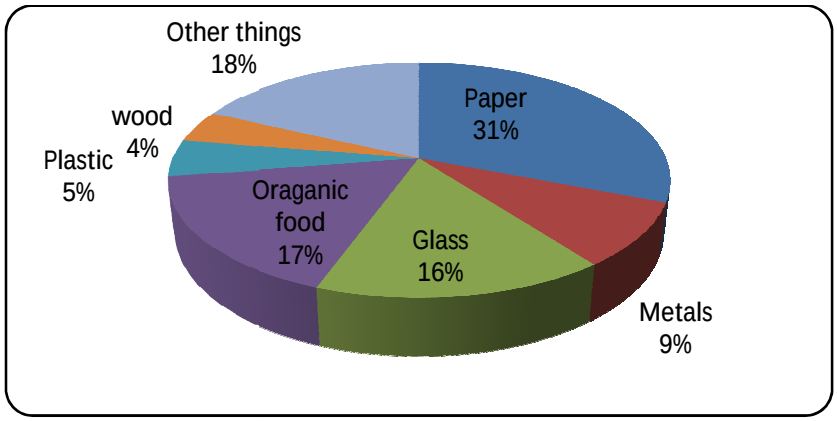

Fig .(5) Percentages of the types of solid waste for January 2012

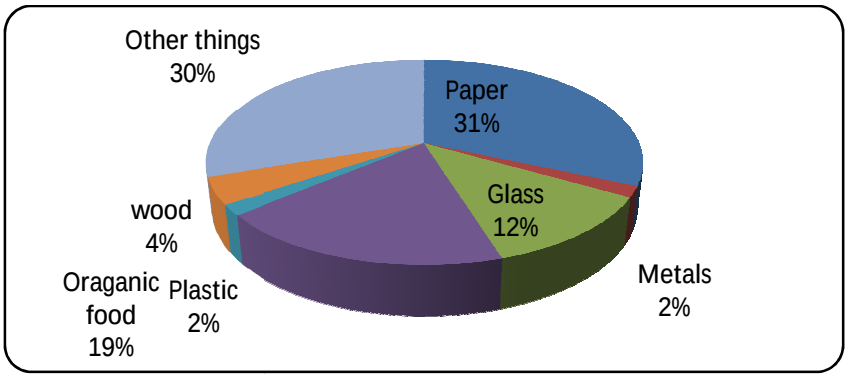

Fig .(6) Percentages of the types of solid waste for February 2012

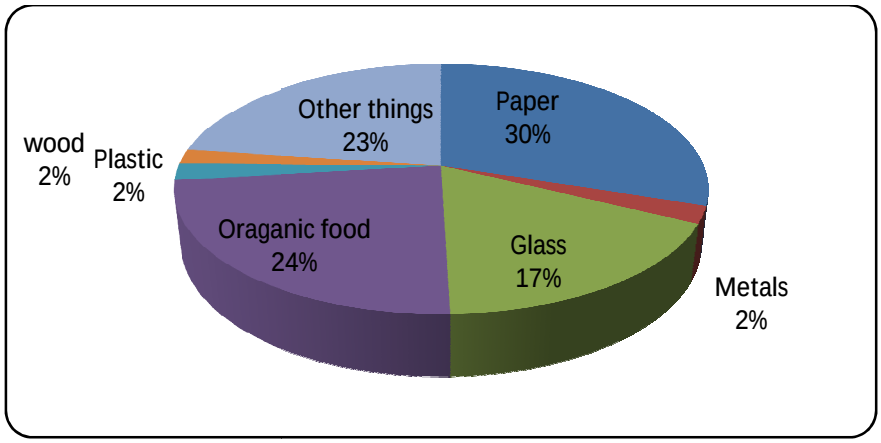

Fig .(7) Percentages of the types of Solid Waste for March 2013

Figure(8) represents the productive rate of the various types of solid wastes produced each month. The minimum value 4.33kg/day was for paper in October 2012 and the maximum value was 19.066kg/day.

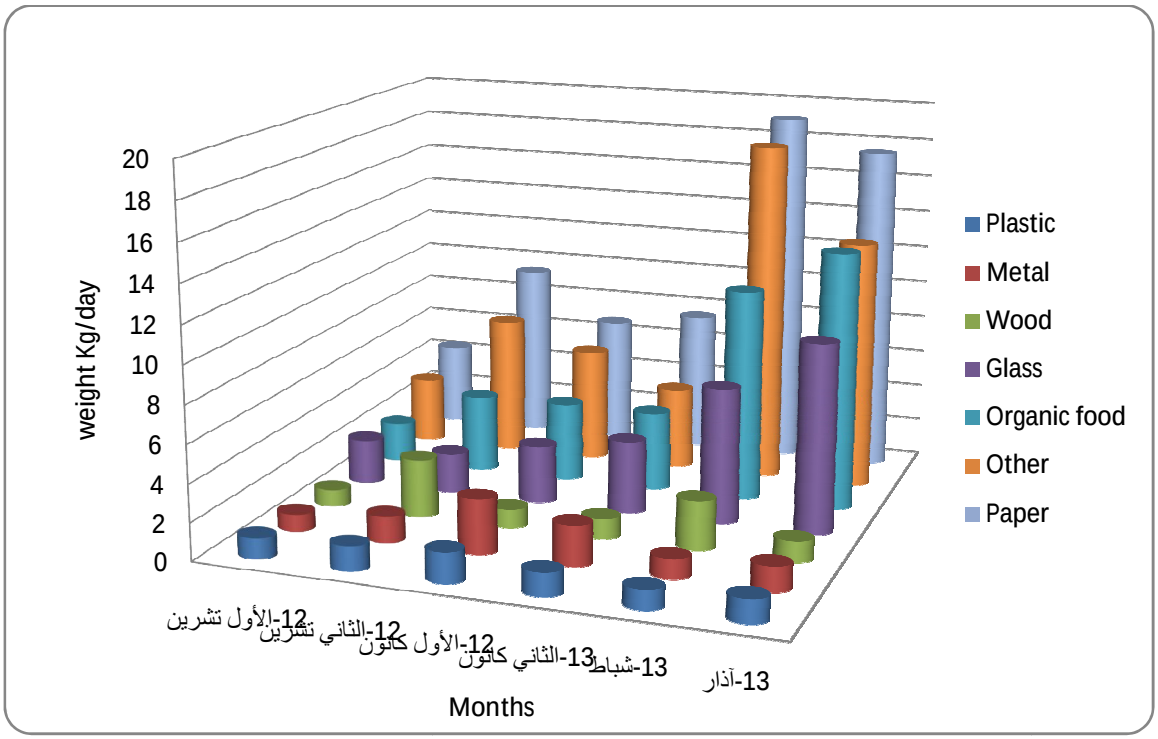

Fig .(8) Production rates of Different Types of Solid Waste

Figure (9) represent the production of solid waste for each departments, the departments differs from each other in production of solid waste due to the number of student, officials and laboratory of the department. The production of solid waste increased with month of year, the highest production for the Withural Electronical Servies was 171.7 Kg/day in March 2013.

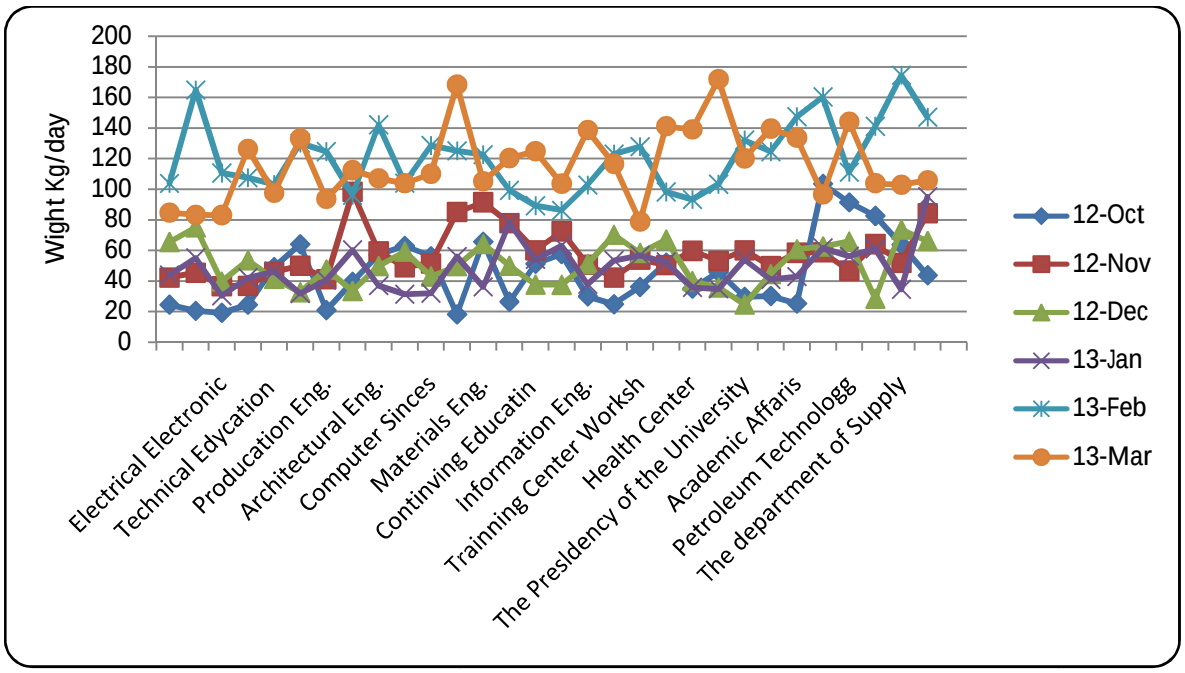

Fig . (9) Production of Solid Waste for Departments for Six Months

Figure(10) represents comparison for the results obtained with three universities. University of Technology shows the highest production, this may be because of the using the recent way, for solid waste managing and disposal like recycling, reuse and recovery. New method must be proposed for lecture presentation to minimum, the quantity of wastes that may produced.

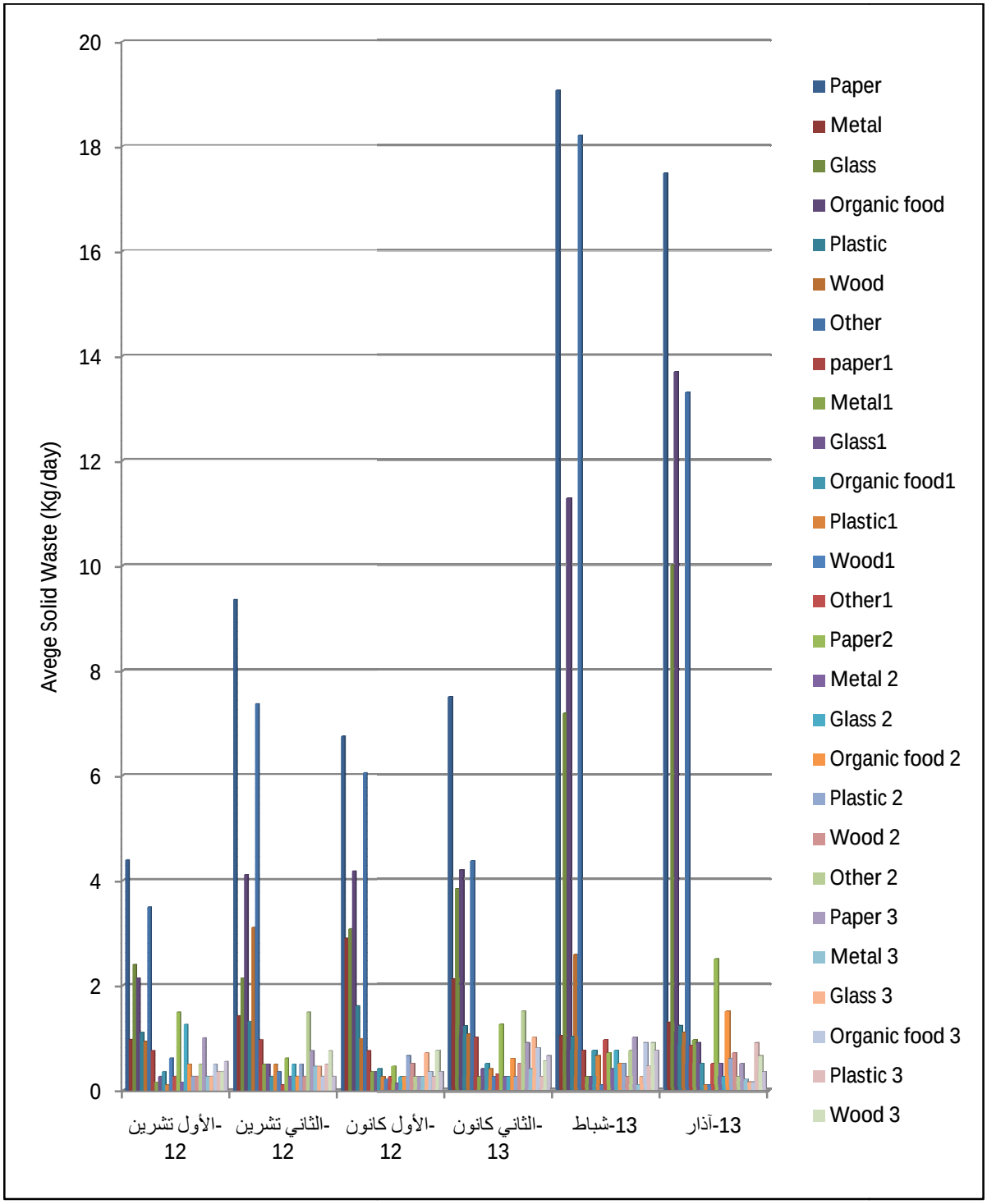

Fig .(10) Comparison for the results obtained with three universities

- Paper1, Metal1, Glass1, Organic food1, Plastic 1, Wood1, Other1. [6]
- Paper2, Metal2, Glass2, Organic food2, Plastic 2, Wood2, Other2. [7]
- Paper3, Metal3, Glass3, Organic food3, Plastic 3, Wood3, Other3. [8]
- Paper, Metal ,Glass, Organic food, Plastic, Wood, Other.(Solid waste for University of Technology)

Table 2 shows the statistical description of the data for Al- Technology University. It has be notated represent the scatter of each component about the mean value and the maximum value for the standard division of the paper.

Table (2) Descriptive Statistics for Al-Technology University

Descriptive Statistics								
	N	Range	Minimum	Maximum	Mean		Std. Deviation	Variance
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
Paper	360	65.00	1.00	66.00	12.9389	.55848	10.59651	112.286
Metal	360	21.90	.10	22.00	1.6742	.12059	2.28799	5.235
Glass	360	24.75	.25	25.00	4.7722	.27915	5.29649	28.053
Organic food	360	43.75	.25	44.00	6.5882	.35560	6.74705	45.523
Plastic	360	12.90	.10	13.00	1.2475	.07807	1.48129	2.194
Wood	360	21.90	.10	22.00	1.6257	.11610	2.20284	4.853
Other	360	54.50	.50	55.00	8.7972	.43793	8.30917	69.042

Conclusions and Recommendation

1. University solid waste is generally similar to that of municipal solid waste.
2. Special containers must be designed for the University for Collection and separation of solid waste.
3. It appears that paper is the largest solid waste quantity which could be recycled or reused.
4. Organic matter waste could be used as a fertilizer for the university gardens and when decomposed methane gas generated which could be used to generate electric power.
5. Solid waste generated at University of Technology was more than wastes generated at other universities in the world because of the new manner used in the world for solid waste treatment and management like separation, reusing , recycling and using internet, data show and new technology devices could reduce the solid waste generation especially paper.
6. The solid waste considered as a natural source for country and reduces environmental pollution.
7. Students enlighten for the importance of the solid waste benefits as a natural reuse and to follow the health ways to eliminate environment pollution by using collection and separation methods through special container.

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