# SOLID WASTE MANAGEMENT IN AIKTC CAMPUS

Submitted in partial fulfillment of the requirements

Of the degree of Bachelor of Engineering

By

**Chawdhary Ashfaque (12CE13)**

**Bhabay Nayab (13CE12)**

**Khan Zubair (13CE29)**

Under guidance of

**Dr. Shabiimam M. A**

Department of Civil Engineering

Anjuman-I-Islam's Kalsekar Technical Campus

Near Thana Naka, New Panvel, Navi Mumbai. 410206

2017-2018

# CERTIFICATE

This is to certify that, Chawdhary Ashfaque (12CE13), Bhabay Nayab (13CE12), and Khan Zubair (13CE29) has satisfactorily completed and delivered a Project report entitled, “Solid Waste Management in AIKTC Campus” in partial fulfillment for the completion of the B.E. in Civil Engineering Course conducted by the University of Mumbai in Anjuman-I-Islam’s Kalsekar Technical Campus, New Panvel, Navi Mumbai, during the academic year 2017-18.

Dr. Shabiimam M. A
(Project Guide)

Dr. Rajendra Magar
(Head of the Department)

**Dr. Abdul Razzak Honnutagi**

**(Director)**

Date: 05-05-2018

Place: Panvel

# APPROVAL SHEET

This dissertation report entitled "Solid Waste Management in AIKTC Campus" by **Mr.** Chawdhary Ashfaque (12CE13), Mr. Bhabay Nayab (13CE12) and Mr. Khan Zubair (13CE29) is approved for the degree of "Civil Engineering".

Examiners

1. …………………………

2. …………………………

Supervisors:

1. …………………………

2. …………………………

Date: 05-05-2018

Place: Panvel

# DECLARATION

We declare that this written submission represents our ideas in our own words and where others ideas or words have been included; we have adequately cited and referenced the original sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

Chawdhary Ashfaque Mukhtar Ahmed (12CE13)

Bhabay Nayab Zubair (13CE12)

Khan Zubair Amir Hasan (13CE29)

Date:05-05-2018

# ABSTRACT

AIKTC, with a population of around 5 thousand people, is located in city New Panvel. Campus produces about 80 to 100 kg of solid waste per day. The aim of this study is to characterize the solid waste in Campus and suggest the suitable methods for disposal. This was achieved by calculating the quantity and composition of waste produced in Campus. Current requirements and challenges in relation to optimization of Campus collection and management system are also discussed. The study were conducted in various waste collection from at AIKTC, there were 8 bins in diploma, 3 bins in diploma canteen, 4 bins in pharmacy building, 2 bins in architecture building, 5 bins in engineering building, 5 bins in degree canteen and apart from this separate small bins were also provide in class rooms and faculty cabins. In this study every day waste generation monitored using weighing balance, the classification and characterization of solid waste also determined. Food waste of around 30 to 40 kg produce in both canteen which contains bread, rice, fruits, vegetables, meat etc, and produce 50 to 60 kg of dry waste which contains paper, plastic, aluminum foil etc, and also E waste of 0.5 kg produce during practical hour per day which contains wires, damaged electronic parts, diode resister etc. Better solid waste management can be achieved by students, staff and institutional involvement.

**Keywords –** Solid waste, Food waste, Waste generation, Moisture content.

# CONTENTS

# LIST OF FIGURES

# LIST OF TABLES

# Chapter 1

# Introduction

## 1.1 General

"Environment" is the live of a people surrounded by the place which consist of living organisms, tree, fresh air, food to eat, water to drink, the land where we live it is a mixture of human made and natural phenomena

Environment is the region surroundings or circumstances in which anything exists, everything external to the organisms. This includes both biotic (pertaining to life) and a biotic (non biological means physical or chemical features of an environment) components.

## 1.2 Impact of Environment on Society

Among all living organisms man influences environment the most and can also modify the environment to some extent as per his needs. Changes in environment affects us. Man has been influencing the environment since the beginning of human civilization through his activities.

Rapid population growth, industrialization, faster modes of transport, urbanization and increasing human activities has contributed to the pollution of environment. Environmental pollution has several impacts on society. Environmental pollution causes serious problems like global warming, depletion of ozone layer, extinction of biodiversity etc. Large scale degradation of the environment not only causes pollution but may jeopardize the very existence of human society.

There is no end to human needs. Desire to develop is one of the basic need of human beings. To satisfy his increasing needs and to develop man has been exploiting nature vigorously which led to serious environmental degradation and pollution. This may have the following impact on society.

## 1.3 Solid Waste Management

Solid waste management involves activity associated with generation, storage, collection, transfer and transport, processing and disposal of solid waste which are environmentally suitable adopting principles of economy, aesthetics energy and conservation. It consist of planning organization, administration, financial, legal and engineering aspects.

As long as people have been living in settlements and residential areas, garbage or solid waste has been an issue. Waste management is all about how solid waste can be changed and used as a valuable resource. Solid waste management should be embraced by each and every household including the business owners across the world. Industrialization has brought a lot of good things and bad things as well. One of the negative effects of industrialization is the creation of solid waste.

## 1.4 Need of the Study

Improper solid waste causes main environmental problems associated with solid waste management are insects, fire, odors, health effects and air pollution.

1) Insects: - it is well known fact that gastro-intestine disease such as bacillary and amoebic dysentery, other diseases such as plague, trichinosis etc. Can be spread by insects vectors breading in solid wastes most of house fly population breed in open garbage dumps. If night soil or un protected latrines are closed to the refuse as is the case in many less developed countries including India, the disease route is wide open. It is known that flies can travel up to 10 kms.

2) Fire: - Fire hazards exist especially for haphazard landfill procedure. The fire start with the objectionable practices of open burning of refuse, although there may be other accidental causes. An addition danger with fire is that if large quantities of wastes are used to put it out, there can be leaching of toxic material to underground water.

3) Odour: - Odour of moist solid waste coupled with the fecal matter that is lying exposed along the roads and open areas in our towns and cities is rather a common occurrence. Many animals including pigs food themselves on the refuse, scattering it in the process. The rotting stink, which persists almost day and night, constitutes a major environmental nuisance as well as hygienic hazard. In decaying vegetables and food water is also involved resulting the odour of hydrogen sulphide is truly unbearable.

4) Health Hazard: - In addition to the diseases that are caused by the vectors such as rats, flies, etc. the handling of refuse itself constitutes a health hazard, especially if night soil is also a part of the refuse. A survey by CPHERI showed that at Bhopal in India, up to half the sample of refuse is slum and poor quarters and at the disposal site contained round worm ova. A smaller but substantial proportion of samples from slum, poor and middle-class areas had whip worm ova.

5) Air pollution: - When refuse is burned in open or in incinerators, a part of dense black smoke often fills the surrounding atmosphere. Also, the resulting fly ash constitutes the main problem, especially in the case of incinerators. There is, however, a problem of burning plastics, whose concentration in the city refuse is steadily growing, the wide packaging material polyvinyl chloride (PVC) for example is about 50% chloride and that element is emitted as toxic hydrogen chloride upon burning.

## 1.5 Aim of the Study

Our main aim of the project is to characterize the solid waste of AIKTC Campus and suggest the suitable methods for solid waste management.

## 1.6 Objectives of the Study

There are following objectives of the project.

- Evaluate the quantity of solid waste generates per day in the AIKTC Campus.
- Identification of waste bin location
- Characterize the waste generates in Campus.
- Propose a suitable methodology for solid waste disposal

## 1.7 Motivation of Study

Increasing urbanization and changing lifestyles has led to the MSW generated in Indian cities having increased from 6 million tons in 1947 to 48.1 million tons in 1997. And the 80 to 90% of the solid waste is disposed off in open dumping. Simply we are wasting the wastes we don't get the revenue from the solid waste because of improper solid waste management. Open dumping causes the adverse effect on environment, it pollute the environment. According to WHO 12.6 million people dying because of unhealthy environment. We can minimize the quantity of disposal solid waste by adopting the proper management system of solid waste and we can save the more life.

## 1.8 Solid Waste Management in AIKTC Campus

Anjuman-I-Islam Kalsekar Technical Campus, New Panvel, India. Providing education Programmes in Engineering & Technology, Pharmacy and Architecture, ranging from Diploma to Degree to Post Graduate courses. AIKTC is spread over 10.50 acres of virgin land with more than 2.36 lakh sq.ft of built-up area and still expanding. And producing high quantity of solid waste.

In order to reduce waste at AIKTC Campus, recycling efforts must be improved and organic recycling services must be provided. Additionally, students, faculty, and staff must be properly educated on proper waste management practices. The constant production of new products and packaging means knowledge of recyclable and compostable materials has become a complex and confusing topic for many people. In a society that values convenience, the current "throwaway" lifestyle encourages a linear approach to the production and disposal of products, rather than a circular approach that regards waste as simply another resource. College students, staff, and faculty often lead busy lives and value convenience; as they go about their day rushing between activities and classes, the purchase of single-use products is often the most convenient choice. The consequence of this convenience comes in the form of high quantities of waste.

Waste management is the collection, transport, processing or disposal, managing and monitoring of waste materials. The term usually relates to materials produced by human activity, and the process is generally under taken to reduce their effect on health, the environment or aesthetics. Waste management is a distinct practice from resource recovery which focuses on delaying the rate of consumption of natural resources. All wastes materials, whether they are solid, liquid, gaseous or radioactive fall within the domain of waste management. It is observed that in the college campus, there are no proper waste management systems. There is no separation of degradable and non-biodegradable materials like plastic. These materials are dumped together in the open space. Plastic materials are being burnt in the open space without using proper incineration techniques, which may cause various health and ecological problems. We can see a lot of solid wastes dumped at the back side of the campus.

Management of solid waste reduces or eliminates adverse impacts on the environment and human health and supports economic development and improved quality of life. Figure 1.1 and Figure 1.2 Figure 1.3 shows that waste generation and storage in Campus.

**Figure 1.1 Waste Generation at Campus**



.

**Figure 1.2 Waste Storage at Campus**

**Table 1.1 Typical solid waste generating facilities, activities and locations associated with various classifications.**

| Source | Typical waste generators | Types of solid wastes |
|---|---|---|
| **Residential** | Single and multifamily dwellings | Food wastes, paper, cardboard, plastics, textiles, leather, yard wastes, wood, glass, metals, ashes, special wastes (e.g., bulky items, consumer electronics, white goods, batteries, oil, tires), and household hazardous wastes.). |
| **Industrial** | Light and heavy manufacturing, fabrication, construction sites, power and chemical plants. | Housekeeping wastes, packaging, food wastes, construction and demolition materials, hazardous wastes, ashes, special wastes. |
| **Commercial** | Stores, hotels, restaurants, markets, office buildings, etc. | Paper, cardboard, plastics, wood, food wastes, glass, metals, special wastes, hazardous wastes. |
| **Institutional** | Schools, hospitals, prisons, government centers. | Same as commercial. |
| **Construction and demolition** | New construction sites, road repair, renovation sites, demolition of buildings | Wood, steel, concrete, dirt, etc. |
| **Municipal services** | Street cleaning, landscaping, parks, beaches, other recreational areas, water and wastewater treatment plants. | Street sweepings; landscape and tree trimmings; general wastes from parks, beaches, and other recreational areas; sludge. |
| **Process (manufacturing, etc.)** | Heavy and light manufacturing, refineries, chemical plants, power plants, mineral extraction and processing. | Industrial process wastes, scrap materials, off-specification products, slay, tailings. |
| **Agriculture** | Crops, orchards, vineyards, dairies, feedlots, farms. | Spoiled food wastes, agricultural wastes, hazardous wastes |

### 1.8.1 Type of Waste Generated in Campus

The various types of solid waste generates in Campus are as follows:-

**Refuse:**

It includes all solid waste of community and semi liquid or wet waste with insufficient liquid content to be free flowing.

**Garbage or food waste:**

It includes food waste, which are animal, fruit or vegetable residue resulting from handling, preparation, cooking and eating of foods. It also include food wastage generated at canteen classroom, kitchen etc, the most important characteristics of these waste are that they are highly putrescible and will decompose rapidly, especially in warm weather, often decomposition will lead to the development of offensive odors.

**Rubbish:**

It consists of combustible and non-combustible solid waste of Institution etc. excluding food waste or other highly putrescible materials. Typically, combustible rubbish consist of materials such as paper, cardboard, plastics, rubber, wood, garden trimmings. Non- Combustible rubbish consist of items such as glass , tin cans , aluminum cans ,ferrous and other non-ferrous matters and dirt.

**Special Waste:**

Waste such as street sweepings, road side litter are classified as Special waste.

**Electronic Waste:**

Waste generated from electrical and computer labs and department offices such as wires, damaged computer parts, diode resistors, capacitor, transformer, inductor, probes, IC etc.

## 1.8.2 Disposal Methods

The disposal of solid waste is one of the most important process involves in solid waste management. The waste may come for disposal either directly after transportation or after processing

The various method of disposal are

1. Recycling
2. Incineration
3. Composting
4. Sanitary land fill
5. Disposal in ocean or sea
6. Pyrolysis

**Recycling:**

Recycling serves to transform the wastes into products of their own genre through industrial processing, Paper, glass, aluminum, and plastics are commonly recycled. It is environmentally friendly to reuse the wastes instead of adding them to nature. However, processing technologies are pretty expensive.

**Incineration**:

Incineration features combustion of wastes to transform them into base components, with the generated heat being trapped for deriving energy. Assorted gases and inert ash are common by-products. Pollution is caused by varied degrees dependent on nature of waste combusted and incinerator design. Use of filters can check pollution. It is rather inexpensive to burn wastes and the waste volume is reduced by about 90%. The nutrient rich ash derived out of burning organic wastes can facilitate hydroponic solutions. Hazardous and toxic wastes can be easily being rid of by using this method. The energy extracted can be used for cooking, heating, and supplying power to turbines. However, strict vigilance and due diligence should be exercised to check the accidental leakage of micro level contaminants, such as dioxins from incinerator lines.

### Composting:

It involves decomposition of organic wastes by microbes by allowing the waste to stay accumulated in a pit for a long period of time. The nutrient rich compost can be used as plant manure. However, the process is slow and consumes a significant amount of land. Biological reprocessing tremendously improves the fertility of the soil.

### Sanitary Landfill:

This involves the dumping of wastes into a landfill. The base is prepared of a protective lining, which serves as a barrier between wastes and ground water and prevents the separation of toxic chemicals into the water zone. Waste layers are subjected to compaction and subsequently coated with an earth layer. Soil that is non-porous is preferred to mitigate the vulnerability of accidental leakage of toxic chemicals. Landfills should be created in places with low groundwater level and far from sources of flooding. However, a sufficient number of skilled manpower is required to maintain sanitary landfills.

### Disposal in ocean/sea:

Wastes generally of radioactive nature are dumped in the oceans far from active human habitats. However, environmentalists are challenging this method, as such an action is believed to spell doom for aquatic life by depriving the ocean waters of its inherent nutrients.

Effective waste disposal calls for concerted efforts from all, no matter how anxious or worried they may be about our environment.

### Pyrolysis:

Pyrolysis is rapidly developing biomass thermal conversion technology and has been garnering much attention worldwide due to its high efficiency and good eco-friendly performance characteristics. Pyrolysis technology provides an opportunity for the conversion of municipal solid wastes, agricultural residues, scrap tires, non-recyclable plastics etc into clean energy. It offers an attractive way of converting urban wastes into products which can be effectively used for the production of heat, electricity and chemicals.

# Chapter 2

# Literature Review

**Carolina Armijo de vega, Sara Ojeda Benitez, Ma. Elizabeth Ramirez Barreto et al (2008)** In Mexico municipal authorities are in charge of the cleaning services of cities including sweeping waste collection and transport. The study of solid waste in the campus of Mexico consisted of three stages:1)estimate of the daily solid waste generation 2) solid waste sampling and characterization of samples 3)data capture and analysis of the amounts and types of wastes generated at the campus.

**Lester B. Lave, Chris T. Hendrickson, Noellette M. Conway-Schempf, and Francis C. McMichael et al (1999)** Reuse (as with old furniture),incinerated(as with burning paper to recover energy), Recycled plastic molded into park benches, To save landfill space, To save money from handling municipal solid waste, To increase environmental quality by lowering discharges of pollutant.

**Hazra, T and Sudha, G et al (2009)** more than 2920 ton/day of SW generated in Kolkata Municipal Corporation was Rs 1590, Private agencies are collecting 55% of the total wastes while KMC is collecting only 45% of waste. Operation and maintenance cost for KMC collection vehicle are Rs 300/tone, compare to Rs 150/tone for private vehicles

**N.Munilakshmi, T. Raj Kumar Reddy, D. Prasanna Kumar, N. Reena Grace et al (2012)** A Case Study Of Sri Venkateswara University College of Engineering Hostel Solid Waste generated Per person was 0.28 kg/person/day and 0.312 kg/person/day for boys and girls respectively. Solid wastes generated due to various activities were determined. From the study it was determined that solid waste management was not satisfactory and deserves improvement. Two bin systems were suggested along with wet wastes to be subjected to bio mechanization to produce methane gas.

**Rishi, R and Rajiv, G and Ashok kumar G et al (2014)** A case study of solid waste management in Chandigarh To encourage the public to separate municipal solid waste and market it directly to the informal network appears to be better option. To tackle the waste generated urban local bodies should invest 35-50% of its fund on solid waste management

**Nekram Rawal , Raj Mohan Singh, and R.C. Vaishya et al (2012)** Specify of the site where MSW is to be managed then collect the information such as type of waste road work, population distribution etc. depending upon characterization and quantification of wastes fix the available facilities ,such as incineration etc. after that apply the technology. If the result is within the available source then technology is to be implemented.

**Avick Sil, Sunil Kumar,** There are various kinds of waste including MSW, industrial, hazardous, biomedical, and E-waste. Each kind of waste has its own characteristics and must be treated properly to avoid environmental damage and health impacts. Waste generation also increases with time, population explosion and habits that influence the waste management which is becoming one of the challenging task of the modern society. But waste can be treated as resource and many valuable products can be obtained from them that would lead to green jobs and betterment of society.

**Chettiyappan Visvanathan Prakriti Kashyap**, The proper inclusion of public participation issues into policy layout is essential to make the public participation an integral and mandatory component than an optional choice. All in all, waste reduction and segregation is inevitably linked to people's behavior or attitudinal correction of reckless consumption of goods. Hence, waste management has a social dimension along with technology needs and the inclusive public engagement is the only way to engender this collective social responsibility.

**Albert J.Klee et al (1993)** The assumptions of traditional sampling theory often are un adjustable when estimating the quantity and composition of solid waste arriving at a given location such as landfill site or at a specific point in an industrial or commercial process .Although the calculations dictated by these protocols are tedious, a computer called protocol ha been developed to perform these calculations.

**Amit Kumar, Manoj Datta, Arvind K.Nema;and Gunjan Rateria et al (2016)** Number of waste dumps in 53 cities of India with 1million plus population. Data was obtained for 62 waste dumps in 26 cities (2015). The modification factor was applied on basis of site condition. The methodology was applied to11 wastes dumps the remedial/closures alternatives.

**Edwin A . Korzun et al (1991)** a reduction of solid waste by about 90% in volume and 70% by weight which reduces the landfill apace required by a community. The destruction of pathogenic organisms, reducing the potential for disease The recycling of the energy component of MSW by recovering the potential heat energy, generally in the form of electricity, which is then sold to offset waste management costs.

**Gary K. Welshans et al (1995)** many of the utilities switching back to coal from oil as a fuel source did not previously have to be concerned with environmental regulations regarding the disposal of coal ash wastes. Today, utilities are very much aware of the importance of RCRA and its role in the overall licensing requirements for coal reconversion projects. Proper attention to the solid waste management aspects a utilities coal reconversion project can expedite the licensing process and, consequently, the overall schedule.

**Ammaiyappan Selvam; Jonathan Wong,** The organic biodegradable fraction could be present about 50 % by weight in developing countries energy recovering possibilities make an alternative to fossil fuel. An accurate knowledge of the quantity and composition of the waste is essential to the success of the resource recovery and energy recovery programs and it is the basis for adopting successful technologies from other regions.

**William F. Ritter and Craig Dsouza**, In India municipalities spend in the range of 20-50% of their budget on handling of municipal waste 91 the no of waste to energy mass-burn plants in India is two, one at the okhla land fill site in new Delhi which takes in 1300t/d to generate 16MW of power, Pune which takes 300t/d to generate 3MW of power.

# Chapter 3

# Materials and Methodology

## 3.1 Materials

Material required for the project as follow:-

1. Measuring tape

   Used for measuring the waste in dustbin.


**Figure 3.1 Measuring tape**

2. Spring weighing

Used for measuring the weight of the bin.


**Figure 3.2 Spring weighing balance**

3. Drying oven

Used for finding the moisture content of solid waste sample.

**Figure 3.3 Drying oven**

4. Digital weighing machine

Used for the weighing the solid waste sample.


**Figure 3.4 Digital weighing equipment**

## 3.2 Methodology

In the study on characterization of solid waste in AIKTC Campus consisted of five main steps as follows:-

1. Zoning of the Campus.
2. Calculation of the daily solid waste generation.
3. Segregation of solid waste.
4. Characterization of solid waste and analysis of the amounts and types of wastes generated at the Campus.
5. E-waste management.

### 3.2.1 Zoning of the Campus

We divided the campus in to different zones.

a. Empty area ( ie. parking area, circulation road area).
b. Green area ( ie. play grounds, tree area; garden area etc).
c. Institutional area ( ie. college building).

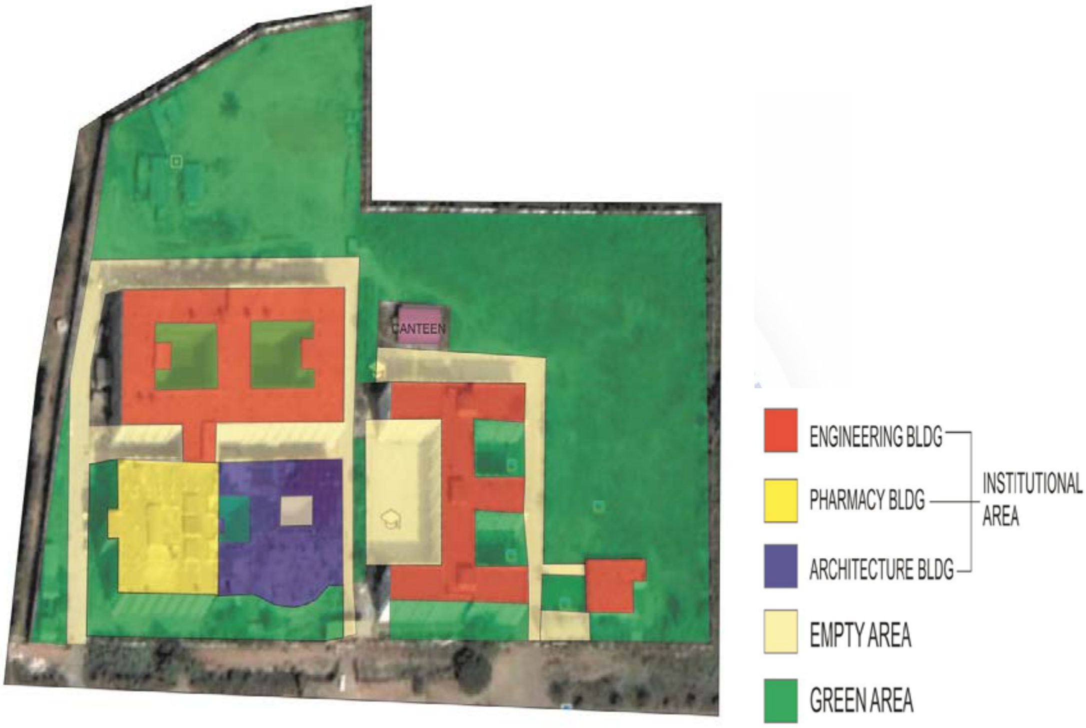



**Figure 3.5 Satellite view of AIKTC Campus**

### 3.2.2 Calculation of the Daily Solid Waste Generation

There are three types of bin in Campus and it is mention in Table 3.1

**Table 3.1 Types of Bins Located in AIKTC Campus**

| BIN TYPES | LENGTH ( m ) | DIAMETER ( m ) | RADIUS ( m ) | VOLUME ( $m^3$ ) | EMPTY WEIGHT ( KG ) |
|---|---|---|---|---|---|
| Type 1 | 0.53 | 0.43 | 0.215 | 0.077 | 2 |
| Type 2 | 0.60 | 0.46 | 0.23 | 0.099 | 3 |
| Type 3 | 0.38 | 0.29 | 0.145 | 0.025 | 0.9 |

The estimate of daily generation was carried out by the volumetric measurement of collection bin. In AIKTC Campus there are twenty eight (28) bins in three different zones and in class rooms and lab small capacity bins are provided for recyclable solid waste, we found the density of different bins solid placed in Campus, by weighing the all bin and found the filled volume of that bin, the ratio of the weight and volume gives the density of the solid waste. We daily measure the height of waste fill in the bin with the use of measurement tap or rope, the height gives the total volume of solid waste and multiplication with the density of solid waste give the weight of the solid waste on that bin.

**Figure 3.6 Calculating the weight of waste of different bins by using weighung balance**


**Figure 3.7 Volume measurement of filled bins**

### 3.2.3 Segregation of Solid Waste

Segregation of solid waste means dividing waste into dry and wet. Dry waste includes wood and related products, metals and glass. Wet waste typically refers to organic waste usually generated by eating establishments and are heavy in weight due to dampness.

Waste sorting is the process by which waste is separated into different elements. Waste sorting can occur manually at the household and collected through curbside collection schemes, or automatically separated in materials recovery facilities or mechanical biological treatment systems. Hand sorting was the first method used in the history of waste sorting.

We have segregate the waste by manually and found the quantity of different element present in the solid waste. We take the three sample of each 10 kg from different places.

**Figure 3.8 Before segregation**

**Figure 3.9 After segregation**

## 3.2.4 Characterization of Solid Waste

Waste characterization is the process by which the composition of different waste streams is analyzed. Waste characterization plays an important part in any treatment of waste which may occur, a knowledge about characteristics of refuse is essential as it enable to decide the type of disposal methods that will have to be adopted and the desired frequency of collection systems.

There are two main characteristics of solid waste:-

1. Physical characteristics.
2. Chemical characteristics.

### Physical Characteristic

#### Density:

It is expressed as mass per unit volume ($kg/m^3$). This parameter is required for designing a solid waste management program. A reduction in volume by 75% is achieved through normal compaction equipment, Significant changes in the density occur as waste moves from sources to disposal site, as A result of scavenging, handling, wetting, and drying by the Weather and vibration during transport. Density is critical in the design of sanitary landfill as well as for storage, collection and transport of wastes.

Efficient operation of landfill requires compaction of wastes to optimum density.

**Procedure to find density:**

First, we have found the volume of the particular bin, and weight that bin filled condition means bin filled with the waste, then found the filled volume of bin with the help of the measuring tape and simple equation, then simply ratio of mass by volume gave the density of solid waste of that bin.

**Figure 3.10 Waste bin Measurement**

### Moisture Content:

The moisture in a sample is expressed as percentage of the wet weight of the MSW material.

**Procedure to find moisture content:**

1. Weigh the empty dish
2. Fill the dish with SW sample and re-weigh
3. SW + dish in an oven for at least 24 hrs at 105°C.
4. Remove the dish from the oven, allow cooling in a desiccator, and weighing.
5. Record the weight of the dry SW + dish.

6. Calculate the moisture content (M) of the SW sample using the equation given below.

$$M = ((W_w - W_d)/W_w) \times 100$$

In which:

M= moisture content (%) of material

$W_W$= wet weight of the sample, and

$W_d$= weight of the sample after drying.

We have prepared the six sample from various dust bins, and put that sample in oven drying equipment for 24 hours at 105 degree Celsius and found the moisture content of the samples.

**Figure 3.11: 6 samples from different bins for moisture analysis**

### 3.2.5 E- Waste Management

Electronic waste or E-Waste are the discarded computers, office. electronic equipment, entertainment device electronics, mobile phones, television sets, and refrigerators. Electronic scrap components, such as CPUs, contain potentially harmful components such as lead, cadmium, beryllium, or brominates flame retardants. Recycling and disposal of e-waste may involve significant risk to health of workers and communities. Proper E-waste management is necessary for human health and communities.

**Collection of E-Waste:**

A separate bin is provided for collection of e-waste in Campus. In our study we found that that daily 0.5 kg of E-waste is generated from Diploma and 0.5 kg from degree building during practical hour per day, which contains wires, damaged electronic parts, diode resister, probe, IC, inductor etc.

**Management of E-Waste:**

Improper disposal of that E waste affect the human and animal health and adverse effect on environment, therefore we suggest the drop point located in Navi Mumbai name as “Green India E-Waste & Re-cycling OPC. Ltd” simply collect all E waste and gave to this organization, they use proper technique for E-waste management.

# Chapter 4

# Results and Discussion

## 4.1 Generation and Density of Waste

The waste generation and of 15 working days has been shown in the Table 4.1 to Table 4.15.

The Waste has been collected and measured by weight and volume. The results shows that every five days average along with weight density of 28 bins where located in Diploma Building – 8 , Diploma Canteen – 3, School of Pharmacy Building – 4, School of Architecture Building- 2, School of Engineering and Technology -5 and Engineering canteen-6 nos. The data were collected at everyday afternoon 2 to 3 pm.

**Table 4.1 Daily waste generation at AIKTC campus Day 1**

| | | | | | Day | 01 |
|---|---|---|---|---|---|---|
| Floor | Bin type | Height filled ( m ) | Radius of bin ( m ) | Filled volume ( m3 ) | Weight of waste ( kg ) | Density ( kg/m3 ) |
| DIPLOMABUILDING | | | | | | |
| DB3.1 | 1 | 0.38 | 0.215 | 0.0552 | 0.950 | 17.21 |
| DB3.2 | 1 | 0.32 | 0.215 | 0.0465 | 0.250 | 5.38 |
| DB2.1 | 1 | 0.16 | 0.215 | 0.0232 | 0.300 | 12.91 |
| DB2.2 | 1 | 0.20 | 0.215 | 0.0291 | 0.800 | 27.53 |
| DB1.1 | 1 | 0.23 | 0.215 | 0.0334 | 0.500 | 14.96 |
| DB1.2 | 1 | 0.19 | 0.215 | 0.0276 | 0.200 | 7.25 |
| DB0.1 | 1 | 0.53 | 0.215 | 0.0770 | 1.500 | 19.48 |
| DB0.2 | 1 | 0.48 | 0.215 | 0.0697 | 1.600 | 22.94 |
| DIPLOMA CANTEEN | | | | | | |
| DBG1 | 3 | 0.38 | 0.145 | 0.0251 | 8.000 | 318.60 |
| DBG2 | 3 | 0.36 | 0.145 | 0.0238 | 7.000 | 294.26 |
| DBG3 | 3 | 0.38 | 0.145 | 0.0251 | 7.250 | 288.73 |
| PHARMACY BUILDING | | | | | | |
| PB3 | 1 | 0.24 | 0.215 | 0.0349 | 1.250 | 35.85 |
| PB2 | 1 | 0.00 | 0.215 | 0.0000 | 0.000 | 0.00 |
| PB1 | 2 | 0.36 | 0.23 | 0.0599 | 0.750 | 12.53 |
| PB0 | 2 | 0.15 | 0.23 | 0.0249 | 0.600 | 24.06 |
| ARCHITECTURE BUILDING | | | | | | |
| AB2 | 1 | 0.28 | 0.215 | 0.0407 | 0.300 | 7.37 |
| AB1 | 1 | 0.32 | 0.215 | 0.0465 | 0.400 | 8.60 |
| AB0 | 1 | 0.05 | 0.215 | 0.0073 | 0.100 | 13.77 |
| ENGG. BUILDING | | | | | | |
| EB3 | 1 | 0.08 | 0.215 | 0.0116 | 0.300 | 25.81 |
| EB2 | 2 | 0.19 | 0.23 | 0.0316 | 0.700 | 22.16 |
| EB1 | 2 | 0.38 | 0.23 | 0.0632 | 2.500 | 39.57 |
| EB0 | 2 | 0.28 | 0.23 | 0.0466 | 3.500 | 75.18 |
| DEGREE CANTEEN | | | | | | |
| EG1 | 1 | 0.53 | 0.215 | 0.0770 | 7.500 | 97.41 |
| EG2 | 1 | 0.51 | 0.215 | 0.0741 | 5.250 | 70.86 |
| EG3 | 1 | 0.52 | 0.215 | 0.0755 | 3.500 | 46.33 |
| EG4 | 3 | 0.38 | 0.145 | 0.0251 | 7.600 | 302.67 |
| EG5 | 3 | 0.31 | 0.145 | 0.0205 | 6.500 | 317.32 |
| EG6 | 3 | 0.30 | 0.145 | 0.0198 | 7.000 | 353.11 |
| | TOTAL WEIGHT | | | = | 76.100 kg | |

**Table 4.2 Daily waste generation at AIKTC campus Day 2**

| | | | | | Day | 02 |
|---|---|---|---|---|---|---|
| Floor | Bin type | Height filled ( m ) | Radius of bin ( m ) | Filled volume ( m3 ) | Weight of waste ( kg ) | Density ( kg/m3 ) |
| DIPLOMA BUILDING | | | | | | |
| DB3.1 | 1 | 0.32 | 0.215 | 0.0465 | 0.900 | 19.36 |
| DB3.2 | 1 | 0.40 | 0.215 | 0.0581 | 1.200 | 20.65 |
| DB2.1 | 1 | 0.18 | 0.215 | 0.0262 | 0.500 | 19.12 |
| DB2.2 | 1 | 0.33 | 0.215 | 0.0479 | 1.000 | 20.86 |
| DB1.1 | 1 | 0.09 | 0.215 | 0.0131 | 0.200 | 15.30 |
| DB1.2 | 1 | 0.16 | 0.215 | 0.0232 | 0.200 | 8.60 |
| DB0.1 | 1 | 0.53 | 0.215 | 0.0770 | 1.750 | 22.73 |
| DB0.2 | 1 | 0.50 | 0.215 | 0.0726 | 2.000 | 27.53 |
| DIPLOMA CANTEEN | | | | | | |
| DBG1 | 3 | 0.20 | 0.145 | 0.0132 | 5.900 | 446.44 |
| DBG2 | 3 | 0.38 | 0.145 | 0.0251 | 8.100 | 322.58 |
| DBG3 | 3 | 0.27 | 0.145 | 0.0178 | 6.800 | 381.14 |
| PHARMACY BUILDING | | | | | | |
| PB3 | 1 | 0.19 | 0.215 | 0.0276 | 0.800 | 28.98 |
| PB2 | 1 | 0.16 | 0.215 | 0.0232 | 0.600 | 25.81 |
| PB1 | 2 | 0.33 | 0.23 | 0.0549 | 0.900 | 16.40 |
| PB0 | 2 | 0.05 | 0.23 | 0.0083 | 0.200 | 24.06 |
| ARCHITECTURE BUILDING | | | | | | |
| AB2 | 1 | 0.20 | 0.215 | 0.0291 | 0.250 | 8.60 |
| AB1 | 1 | 0.28 | 0.215 | 0.0407 | 0.400 | 9.83 |
| ENGG. BUILDING | | | | | | |
| EB3.1 | 1 | 0.05 | 0.215 | 0.0073 | 0.200 | 27.53 |
| EB3.2 | 1 | 0.13 | 0.215 | 0.0189 | 0.500 | 26.47 |
| EB2 | 2 | 0.30 | 0.23 | 0.0499 | 0.650 | 13.03 |
| EB1 | 2 | 0.08 | 0.23 | 0.0133 | 0.300 | 22.56 |
| EB0 | 2 | 0.36 | 0.23 | 0.0599 | 3.200 | 53.46 |
| DEGREE CANTEEN | | | | | | |
| EG1 | 1 | 0.50 | 0.215 | 0.0726 | 7.500 | 103.25 |
| EG2 | 1 | 0.53 | 0.215 | 0.0770 | 6.300 | 81.82 |
| EG3 | 1 | 0.53 | 0.215 | 0.0770 | 4.200 | 54.55 |
| EG4 | 3 | 0.35 | 0.145 | 0.0231 | 7.200 | 311.32 |
| EG5 | 3 | 0.32 | 0.145 | 0.0211 | 6.800 | 321.59 |
| EG6 | 3 | 0.28 | 0.145 | 0.0185 | 6.250 | 337.80 |
| TOTAL WEIGHT | | | | = | 74.800 kg | |

**Table 4.3 Daily waste generation at AIKTC campus Day 3**

| | | | | | Day | 03 |
|---|---|---|---|---|---|---|
| Floor | Bin type | Height filled ( m ) | Radius of bin ( m ) | Filled volume ( m3 ) | Weight of waste ( kg ) | Density ( kg/m3 ) |
| DIPLOMA BUILDING | | | | | | |
| DB3.1 | 1 | 0.41 | 0.215 | 0.0596 | 1.200 | 20.15 |
| DB3.2 | 1 | 0.32 | 0.215 | 0.0465 | 0.600 | 12.91 |
| DB2.1 | 1 | 0.19 | 0.215 | 0.0276 | 0.500 | 18.11 |
| DB2.2 | 1 | 0.35 | 0.215 | 0.0508 | 1.100 | 21.63 |
| DB1.1 | 1 | 0.08 | 0.215 | 0.0116 | 0.300 | 25.81 |
| DB1.2 | 1 | 0.22 | 0.215 | 0.0320 | 0.550 | 17.21 |
| DB0.1 | 1 | 0.50 | 0.215 | 0.0726 | 1.500 | 20.65 |
| DB0.2 | 1 | 0.43 | 0.215 | 0.0625 | 1.300 | 20.81 |
| DIPLOMA CANTEEN | | | | | | |
| DBG1 | 3 | 0.25 | 0.145 | 0.0165 | 6.000 | 363.20 |
| DBG2 | 3 | 0.38 | 0.145 | 0.0251 | 7.900 | 314.62 |
| DBG3 | 3 | 0.38 | 0.145 | 0.0251 | 7.500 | 298.69 |
| PHARMACY BUILDING | | | | | | |
| PB3 | 1 | 0.15 | 0.215 | 0.0218 | 0.600 | 27.53 |
| PB2 | 1 | 0.21 | 0.215 | 0.0305 | 0.750 | 24.58 |
| PB1 | 2 | 0.31 | 0.23 | 0.0515 | 0.700 | 13.58 |
| PB0 | 2 | 0.12 | 0.23 | 0.0200 | 0.400 | 20.05 |
| ARCHITECTURE BUILDING | | | | | | |
| AB2 | 1 | 0.25 | 0.215 | 0.0363 | 0.700 | 19.27 |
| AB1 | 1 | 0.29 | 0.215 | 0.0421 | 0.450 | 10.68 |
| ENGG. BUILDING | | | | | | |
| EB3.1 | 1 | 0.10 | 0.215 | 0.0145 | 0.200 | 13.77 |
| EB3.2 | 1 | 0.32 | 0.215 | 0.0465 | 0.650 | 13.98 |
| EB2 | 2 | 0.15 | 0.23 | 0.0249 | 0.500 | 20.05 |
| EB1 | 2 | 0.18 | 0.23 | 0.0299 | 0.250 | 8.35 |
| EB0 | 2 | 0.33 | 0.23 | 0.0549 | 1.250 | 22.78 |
| DEGREE CANTEEN | | | | | | |
| EG1 | 1 | 0.53 | 0.215 | 0.0770 | 9.500 | 123.38 |
| EG2 | 1 | 0.52 | 0.215 | 0.0755 | 7.250 | 95.97 |
| EG3 | 1 | 0.45 | 0.215 | 0.0654 | 4.000 | 61.19 |
| EG4 | 3 | 0.38 | 0.145 | 0.0251 | 7.600 | 302.67 |
| EG5 | 3 | 0.32 | 0.145 | 0.0211 | 6.800 | 321.59 |
| EG6 | 3 | 0.25 | 0.145 | 0.0165 | 5.500 | 332.94 |
| TOTAL WEIGHT | | | | = | **75.550 kg** | |

**Table 4.4 Daily waste generation at AIKTC campus Day 4**

| | | | | | Day | 04 |
|---|---|---|---|---|---|---|
| Floor | Bin type | Height filled ( m ) | Radius of bin ( m ) | Filled volume ( m3 ) | Weight of waste ( kg ) | Density ( kg/m3 ) |
| DIPLOMA BUILDING | | | | | | |
| DB3.1 | 1 | 0.35 | 0.215 | 0.0508 | 1.000 | 19.67 |
| DB3.2 | 1 | 0.20 | 0.215 | 0.0291 | 0.500 | 17.21 |
| DB2.1 | 1 | 0.18 | 0.215 | 0.0262 | 0.650 | 24.86 |
| DB2.2 | 1 | 0.23 | 0.215 | 0.0334 | 0.800 | 23.94 |
| DB1.1 | 1 | 0.05 | 0.215 | 0.0073 | 0.200 | 27.53 |
| DB1.2 | 1 | 0.29 | 0.215 | 0.0421 | 0.500 | 11.87 |
| DB0.1 | 1 | 0.48 | 0.215 | 0.0697 | 0.850 | 12.19 |
| DB0.2 | 1 | 0.10 | 0.215 | 0.0145 | 0.300 | 20.65 |
| DIPLOMA CANTEEN | | | | | | |
| DBG1 | 3 | 0.38 | 0.145 | 0.0251 | 7.500 | 298.69 |
| DBG2 | 3 | 0.37 | 0.145 | 0.0244 | 7.800 | 319.03 |
| DBG3 | 3 | 0.38 | 0.145 | 0.0251 | 7.200 | 286.74 |
| PHARMACY BUILDING | | | | | | |
| PB3 | 1 | 0.10 | 0.215 | 0.0145 | 0.500 | 34.42 |
| PB2 | 1 | 0.00 | 0.215 | 0.0000 | 0.000 | 0.00 |
| PB1 | 2 | 0.25 | 0.23 | 0.0416 | 0.450 | 10.83 |
| PB0 | 2 | 0.40 | 0.23 | 0.0665 | 1.300 | 19.55 |
| ARCHITECTURE BUILDING | | | | | | |
| AB2 | 1 | 0.50 | 0.215 | 0.0726 | 1.500 | 20.65 |
| AB1 | 1 | 0.10 | 0.215 | 0.0145 | 0.600 | 41.30 |
| ENGG. BUILDING | | | | | | |
| EB3.1 | 1 | 0.06 | 0.215 | 0.0087 | 0.200 | 22.94 |
| EB3.2 | 1 | 0.28 | 0.215 | 0.0407 | 0.750 | 18.44 |
| EB2 | 2 | 0.43 | 0.23 | 0.0715 | 0.900 | 12.59 |
| EB1 | 2 | 0.25 | 0.23 | 0.0416 | 0.450 | 10.83 |
| EB0 | 2 | 0.23 | 0.23 | 0.0382 | 0.600 | 15.69 |
| DEGREE CANTEEN | | | | | | |
| EG1 | 1 | 0.14 | 0.215 | 0.0203 | 1.100 | 54.08 |
| EG2 | 1 | 0.53 | 0.215 | 0.0770 | 9.500 | 123.38 |
| EG3 | 1 | 0.52 | 0.215 | 0.0755 | 7.800 | 103.25 |
| EG4 | 3 | 0.38 | 0.145 | 0.0251 | 7.600 | 302.67 |
| EG5 | 3 | 0.30 | 0.145 | 0.0198 | 6.400 | 322.85 |
| EG6 | 3 | 0.32 | 0.145 | 0.0211 | 6.000 | 283.75 |
| TOTALWEIGHT | | | | = | **72.950 kg** | |

**Table 4.5 Daily waste generation at AIKTC Campus Day 5**

| | | | | | Day | 04 |
|---|---|---|---|---|---|---|
| Floor | Bin type | Height filled ( m ) | Radius of bin ( m ) | Filled volume ( m3 ) | Weight of waste ( kg ) | Density ( kg/m3 ) |
| DIPLOMA BUILDING | | | | | | |
| DB3.1 | 1 | 0.33 | 0.215 | 0.0479 | 2.200 | 45.89 |
| DB3.2 | 1 | 0.37 | 0.215 | 0.0538 | 1.800 | 33.49 |
| DB2.1 | 1 | 0.04 | 0.215 | 0.0058 | 0.150 | 25.81 |
| DB2.2 | 1 | 0.31 | 0.215 | 0.0450 | 1.200 | 26.65 |
| DB1.1 | 1 | 0.38 | 0.215 | 0.0552 | 2.000 | 36.23 |
| DB1.2 | 1 | 0.00 | 0.215 | 0.0000 | 0.000 | 0.00 |
| DB0.1 | 1 | 0.10 | 0.215 | 0.0145 | 0.500 | 34.42 |
| DB0.2 | 1 | 0.46 | 0.215 | 0.0668 | 3.400 | 50.88 |
| DIPLOMA CANTEEN | | | | | | |
| DBG1 | 3 | 0.38 | 0.145 | 0.0251 | 8.700 | 346.48 |
| DBG2 | 3 | 0.38 | 0.145 | 0.0251 | 7.900 | 314.62 |
| DBG3 | 3 | 0.37 | 0.145 | 0.0244 | 7.200 | 294.49 |
| PHARMACY BUILDING | | | | | | |
| PB3 | 1 | 0.50 | 0.215 | 0.0726 | 1.700 | 23.40 |
| PB2 | 1 | 0.23 | 0.215 | 0.0334 | 0.250 | 7.48 |
| PB1 | 2 | 0.21 | 0.23 | 0.0349 | 0.600 | 17.19 |
| PB0 | 2 | 0.17 | 0.23 | 0.0283 | 1.200 | 42.46 |
| ARCHITECTURE BUILDING | | | | | | |
| AB2 | 1 | 0.00 | 0.215 | 0.0000 | 0.000 | 0.00 |
| AB1 | 1 | 0.17 | 0.215 | 0.0247 | 1.700 | 68.83 |
| ENGG. BUILDING | | | | | | |
| EB3.1 | 1 | 0.27 | 0.215 | 0.0392 | 0.450 | 11.47 |
| EB3.2 | 1 | 0.18 | 0.215 | 0.0262 | 0.900 | 34.42 |
| EB2 | 2 | 0.53 | 0.23 | 0.0881 | 3.200 | 36.32 |
| EB1 | 2 | 0.05 | 0.23 | 0.0083 | 0.200 | 24.06 |
| EB0 | 2 | 0.07 | 0.23 | 0.0116 | 0.500 | 42.96 |
| DEGREE CANTEEN | | | | | | |
| EG1 | 1 | 0.53 | 0.215 | 0.0770 | 7.500 | 97.41 |
| EG2 | 1 | 0.52 | 0.215 | 0.0755 | 9.000 | 119.13 |
| EG3 | 1 | 0.50 | 0.215 | 0.0726 | 6.250 | 86.04 |
| EG4 | 3 | 0.30 | 0.145 | 0.0198 | 5.200 | 262.31 |
| EG5 | 3 | 0.27 | 0.145 | 0.0178 | 4.800 | 269.04 |
| EG6 | 3 | 0.38 | 0.145 | 0.0251 | 8.100 | 322.58 |
| TOTALWEIGHT | | | | = | **86.600 kg** | |

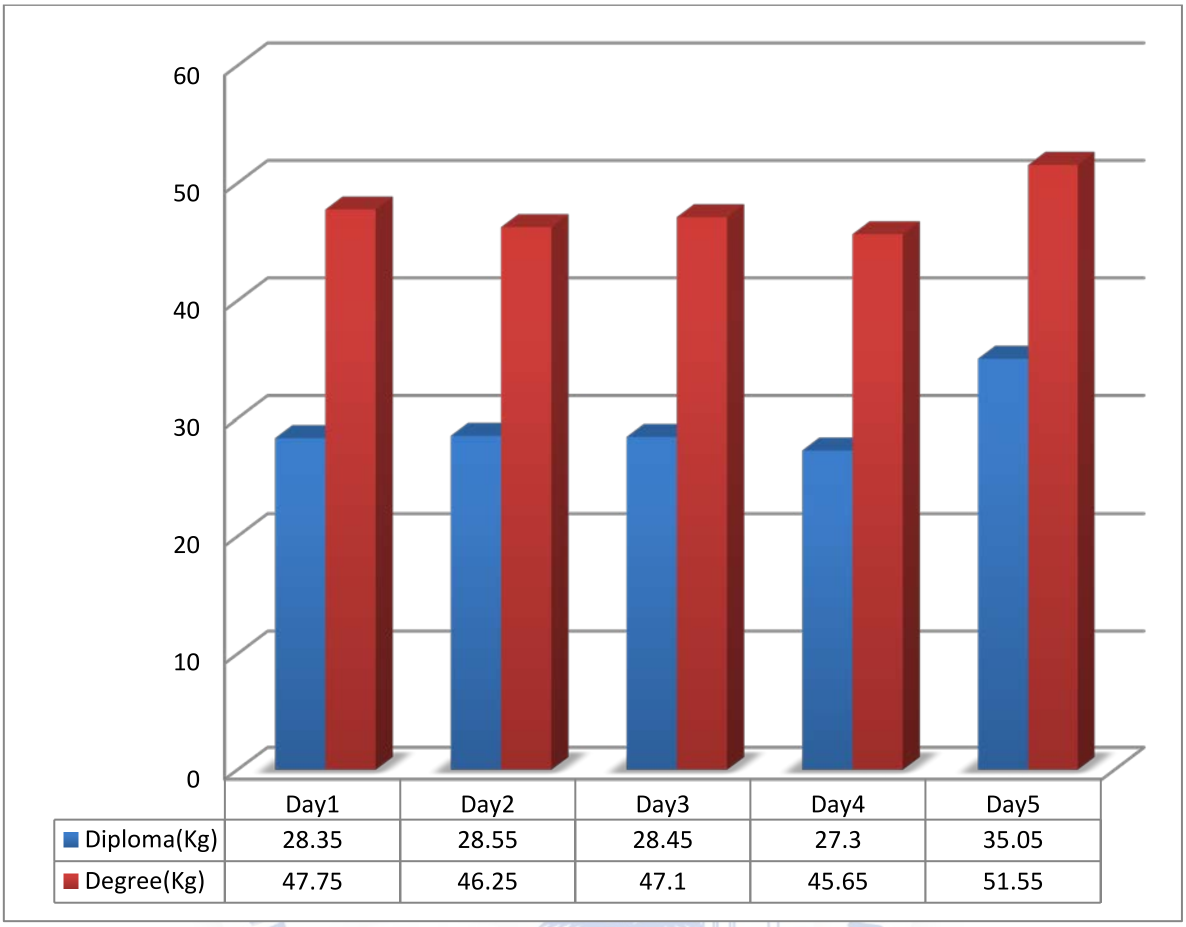



**Figure 4.1: 5 day comparison of daily waste generation in Degree and Diploma building**

Figure 4.1 shows that the Diploma building produces average of 30 kg of waste per day and Degree building produces 48 kg of waste per day.

**Table 4.6 Daily waste generation at AIKTC Campus Day 6**

| | | | | | Day | 06 |
|---|---|---|---|---|---|---|
| Floor | Bin type | Height filled ( m ) | Radius of bin ( m ) | Filled volume ( m3 ) | Weight of waste ( kg ) | Density ( kg/m3 ) |
| DIPLOMA BUILDING | | | | | | |
| DB3.1 | 1 | 0.50 | 0.215 | 0.0726 | 1.900 | 26.16 |
| DB3.2 | 1 | 0.45 | 0.215 | 0.0654 | 1.500 | 22.94 |
| DB2.1 | 1 | 0.20 | 0.215 | 0.0291 | 0.600 | 20.65 |
| DB2.2 | 1 | 0.23 | 0.215 | 0.0334 | 0.500 | 14.96 |
| DB1.1 | 1 | 0.15 | 0.215 | 0.0218 | 0.300 | 13.77 |
| DB1.2 | 1 | 0.35 | 0.215 | 0.0508 | 0.800 | 0.00 |
| DB0.1 | 1 | 0.19 | 0.215 | 0.0276 | 0.400 | 14.49 |
| DB0.2 | 1 | 0.35 | 0.215 | 0.0508 | 1.250 | 24.58 |
| DIPLOMA CANTEEN | | | | | | |
| DBG1 | 3 | 0.37 | 0.145 | 0.0244 | 7.500 | 306.76 |
| DBG2 | 3 | 0.34 | 0.145 | 0.0225 | 6.900 | 307.12 |
| DBG3 | 3 | 0.38 | 0.145 | 0.0251 | 7.800 | 310.63 |
| PHARMACY BUILDING | | | | | | |
| PB3 | 1 | 0.08 | 0.215 | 0.0116 | 0.300 | 25.81 |
| PB2 | 1 | 0.17 | 0.215 | 0.0247 | 0.200 | 8.10 |
| PB1 | 2 | 0.15 | 0.23 | 0.0249 | 0.600 | 24.06 |
| PB0 | 2 | 0.05 | 0.23 | 0.0083 | 0.150 | 18.04 |
| ARCHITECTURE BUILDING | | | | | | |
| AB2 | 1 | 0.05 | 0.215 | 0.0073 | 0.200 | 27.53 |
| AB1 | 1 | 0.11 | 0.215 | 0.0160 | 0.500 | 31.29 |
| ENGG. BUILDING | | | | | | |
| EB3.1 | 1 | 0.15 | 0.215 | 0.0218 | 0.550 | 25.24 |
| EB3.2 | 1 | 0.36 | 0.215 | 0.0523 | 1.500 | 28.68 |
| EB2 | 2 | 0.12 | 0.23 | 0.0200 | 0.700 | 35.09 |
| EB1 | 2 | 0.40 | 0.23 | 0.0665 | 2.500 | 37.59 |
| EB0 | 2 | 0.42 | 0.23 | 0.0698 | 3.250 | 46.54 |
| DEGREE CANTEEN | | | | | | |
| EG1 | 1 | 0.42 | 0.215 | 0.0610 | 6.800 | 111.44 |
| EG2 | 1 | 0.52 | 0.215 | 0.0755 | 7.400 | 97.96 |
| EG3 | 1 | 0.53 | 0.215 | 0.0770 | 8.250 | 107.15 |
| EG4 | 3 | 0.38 | 0.145 | 0.0251 | 7.600 | 302.67 |
| EG5 | 3 | 0.38 | 0.145 | 0.0251 | 7.200 | 286.74 |
| EG6 | 3 | 0.31 | 0.145 | 0.0205 | 5.700 | 278.26 |
| | TOTAL WEIGHT | | | = | 82.850 kg | |

**Table 4.7 Daily waste generation at AIKTC Campus Day 7**

| Floor | Bin type | Height filled ( m ) | Radius of bin ( m ) | Filled volume ( m3 ) | Weight of waste ( kg ) | Density ( kg/m3 ) |
|---|---|---|---|---|---|---|
| | | | | | Day | 07 |
| DIPLOMA BUILDING | | | | | | |
| DB3.1 | 1 | 0.32 | 0.215 | 0.0465 | 1.900 | 40.87 |
| DB3.2 | 1 | 0.40 | 0.215 | 0.0581 | 1.700 | 29.25 |
| DB2.1 | 1 | 0.21 | 0.215 | 0.0305 | 0.450 | 14.75 |
| DB2.2 | 1 | 0.30 | 0.215 | 0.0436 | 0.900 | 20.65 |
| DB1.1 | 1 | 0.16 | 0.215 | 0.0232 | 0.350 | 15.06 |
| DB1.2 | 1 | 0.35 | 0.215 | 0.0508 | 0.850 | 0.00 |
| DB0.1 | 1 | 0.19 | 0.215 | 0.0276 | 0.600 | 21.74 |
| DB0.2 | 1 | 0.30 | 0.215 | 0.0436 | 1.250 | 28.68 |
| DIPLOMA CANTEEN | | | | | | |
| DBG1 | 3 | 0.32 | 0.145 | 0.0211 | 7.200 | 340.50 |
| DBG2 | 3 | 0.36 | 0.145 | 0.0238 | 7.000 | 294.26 |
| DBG3 | 3 | 0.38 | 0.145 | 0.0251 | 6.800 | 270.81 |
| PHARMACY BUILDING | | | | | | |
| PB3 | 1 | 0.18 | 0.215 | 0.0262 | 0.500 | 19.12 |
| PB2 | 1 | 0.17 | 0.215 | 0.0247 | 0.600 | 24.29 |
| PB1 | 2 | 0.35 | 0.23 | 0.0582 | 0.850 | 14.61 |
| PB0 | 2 | 0.33 | 0.23 | 0.0549 | 0.950 | 17.32 |
| ARCHITECTURE BUILDING | | | | | | |
| AB2 | 1 | 0.30 | 0.215 | 0.0436 | 0.350 | 8.03 |
| AB1 | 1 | 0.48 | 0.215 | 0.0697 | 1.100 | 15.77 |
| ENGG. BUILDING | | | | | | |
| EB3.1 | 1 | 0.38 | 0.215 | 0.0552 | 0.700 | 12.68 |
| EB3.2 | 1 | 0.20 | 0.215 | 0.0291 | 0.450 | 15.49 |
| EB2 | 2 | 0.46 | 0.23 | 0.0765 | 1.300 | 17.00 |
| EB1 | 2 | 0.40 | 0.23 | 0.0665 | 1.050 | 15.79 |
| EB0 | 2 | 0.25 | 0.23 | 0.0416 | 0.600 | 14.44 |
| DEGREE CANTEEN | | | | | | |
| EG1 | 1 | 0.28 | 0.215 | 0.0407 | 4.800 | 118.00 |
| EG2 | 1 | 0.53 | 0.215 | 0.0770 | 8.400 | 109.09 |
| EG3 | 1 | 0.53 | 0.215 | 0.0770 | 7.250 | 94.16 |
| EG4 | 3 | 0.34 | 0.145 | 0.0225 | 5.600 | 249.26 |
| EG5 | 3 | 0.37 | 0.145 | 0.0244 | 6.900 | 282.22 |
| EG6 | 3 | 0.38 | 0.145 | 0.0251 | 8.100 | 322.58 |
| | TOTAL WEIGHT | | | = | 78.500 kg | |

**Table 4.8 Daily waste generation at AIKTC Campus Day 8**

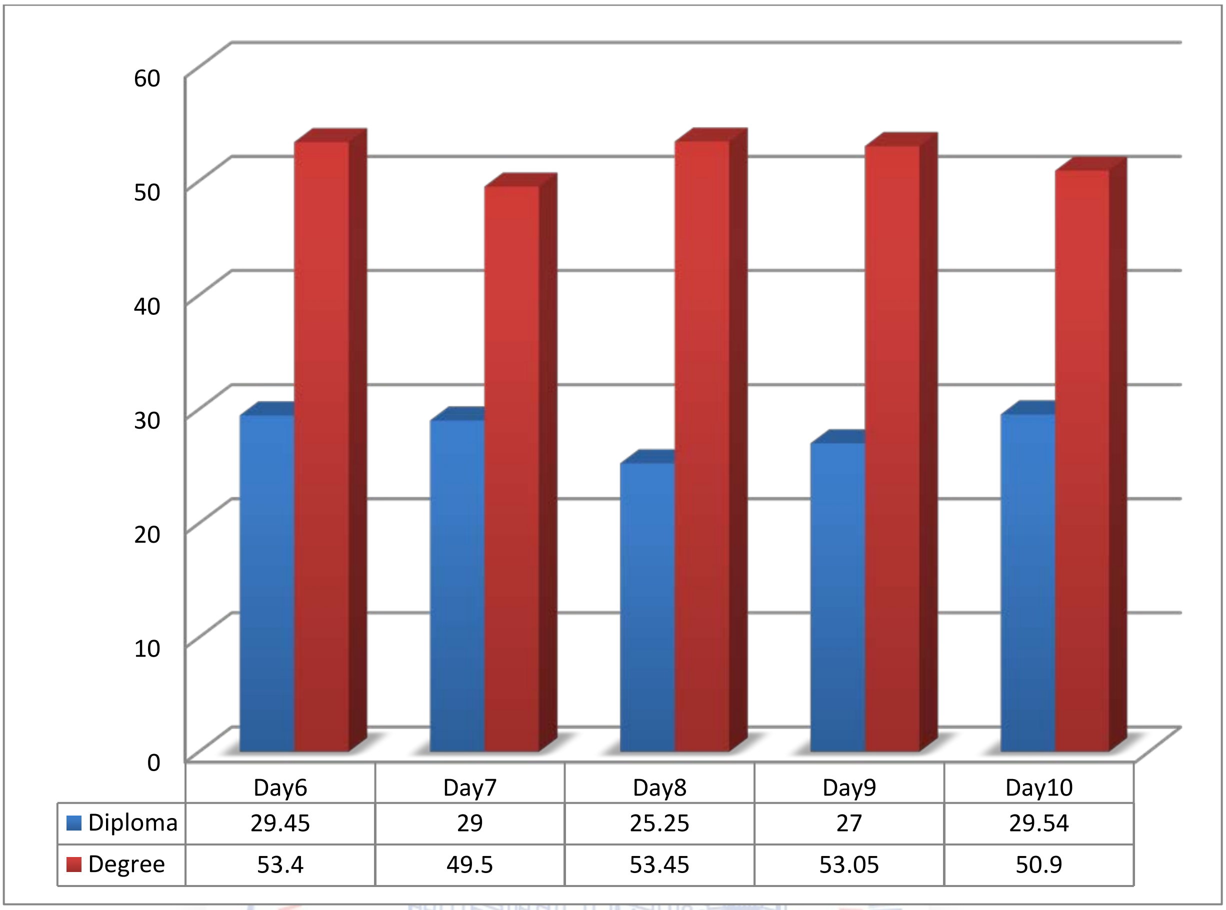
| | | | | | Day | 08 |
|---|---|---|---|---|---|---|
| Floor | Bin type | Height filled ( m ) | Radius of bin ( m ) | Filled volume ( m3 ) | Weight of waste ( kg ) | Density ( kg/m3 ) |
| DIPLOMA BUILDING | | | | | | |
| DB3.1 | 1 | 0.21 | 0.215 | 0.0305 | 0.500 | 16.39 |
| DB3.2 | 1 | 0.53 | 0.215 | 0.0770 | 1.400 | 18.18 |
| DB2.1 | 1 | 0.24 | 0.215 | 0.0349 | 0.600 | 17.21 |
| DB2.2 | 1 | 0.53 | 0.215 | 0.0770 | 1.500 | 19.48 |
| DB1.1 | 1 | 0.43 | 0.215 | 0.0625 | 0.850 | 13.61 |
| DB1.2 | 1 | 0.38 | 0.215 | 0.0552 | 0.550 | 0.00 |
| DB0.1 | 1 | 0.28 | 0.215 | 0.0407 | 0.700 | 17.21 |
| DB0.2 | 1 | 0.40 | 0.215 | 0.0581 | 1.100 | 18.93 |
| DIPLOMA CANTEEN | | | | | | |
| DBG1 | 3 | 0.38 | 0.145 | 0.0251 | 6.200 | 246.91 |
| DBG2 | 3 | 0.27 | 0.145 | 0.0178 | 6.000 | 336.30 |
| DBG3 | 3 | 0.31 | 0.145 | 0.0205 | 5.850 | 285.58 |
| PHARMACY BUILDING | | | | | | |
| PB3 | 1 | 0.45 | 0.215 | 0.0654 | 0.900 | 13.77 |
| PB2 | 1 | 0.10 | 0.215 | 0.0145 | 0.400 | 27.53 |
| PB1 | 2 | 0.06 | 0.23 | 0.0100 | 0.350 | 35.09 |
| PB0 | 2 | 0.42 | 0.23 | 0.0698 | 1.000 | 14.32 |
| ARCHITECTURE BUILDING | | | | | | |
| AB2 | 1 | 0.10 | 0.215 | 0.0145 | 0.500 | 34.42 |
| AB1 | 1 | 0.45 | 0.215 | 0.0654 | 1.650 | 25.24 |
| ENGG. BUILDING | | | | | | |
| EB3.1 | 1 | 0.24 | 0.215 | 0.0349 | 0.600 | 17.21 |
| EB3.2 | 1 | 0.10 | 0.215 | 0.0145 | 0.300 | 20.65 |
| EB2 | 2 | 0.18 | 0.23 | 0.0299 | 0.550 | 18.38 |
| EB1 | 2 | 0.34 | 0.23 | 0.0565 | 0.800 | 14.15 |
| EB0 | 2 | 0.48 | 0.23 | 0.0798 | 1.300 | 16.29 |
| DEGREE CANTEEN | | | | | | |
| EG1 | 1 | 0.53 | 0.215 | 0.0770 | 9.000 | 116.89 |
| EG2 | 1 | 0.50 | 0.215 | 0.0726 | 8.200 | 112.89 |
| EG3 | 1 | 0.52 | 0.215 | 0.0755 | 7.250 | 95.97 |
| EG4 | 3 | 0.28 | 0.145 | 0.0185 | 4.600 | 248.62 |
| EG5 | 3 | 0.38 | 0.145 | 0.0251 | 7.500 | 298.69 |
| EG6 | 3 | 0.38 | 0.145 | 0.0251 | 8.550 | 340.50 |
| | TOTAL WEIGHT | | | = | 78.700 kg | |

**Table 4.9 Daily waste generation at AIKTC Campus Day 9**

| | | | | | Day | 09 |
|---|---|---|---|---|---|---|
| Floor | Bin type | Height filled ( m ) | Radius of bin ( m ) | Filled volume ( m3 ) | Weight of waste ( kg ) | Density ( kg/m3 ) |
| DIPLOMA BUILDING | | | | | | |
| DB3.1 | 1 | 0.14 | 0.215 | 0.0203 | 0.300 | 14.75 |
| DB3.2 | 1 | 0.45 | 0.215 | 0.0654 | 1.250 | 19.12 |
| DB2.1 | 1 | 0.23 | 0.215 | 0.0334 | 0.700 | 20.95 |
| DB2.2 | 1 | 0.53 | 0.215 | 0.0770 | 1.700 | 22.08 |
| DB1.1 | 1 | 0.20 | 0.215 | 0.0291 | 0.600 | 20.65 |
| DB1.2 | 1 | 0.53 | 0.215 | 0.0770 | 1.600 | 20.78 |
| DB0.1 | 1 | 0.36 | 0.215 | 0.0523 | 0.900 | 17.21 |
| DB0.2 | 1 | 0.19 | 0.215 | 0.0276 | 0.450 | 16.30 |
| DIPLOMA CANTEEN | | | | | | |
| DBG1 | 3 | 0.38 | 0.145 | 0.0251 | 7.600 | 302.67 |
| DBG2 | 3 | 0.31 | 0.145 | 0.0205 | 6.000 | 292.91 |
| DBG3 | 3 | 0.36 | 0.145 | 0.0238 | 5.900 | 248.02 |
| PHARMACY BUILDING | | | | | | |
| PB3 | 1 | 0.35 | 0.215 | 0.0508 | 0.800 | 15.73 |
| PB2 | 1 | 0.17 | 0.215 | 0.0247 | 0.400 | 16.20 |
| PB1 | 2 | 0.15 | 0.23 | 0.0249 | 0.150 | 6.01 |
| PB0 | 2 | 0.38 | 0.23 | 0.0632 | 1.100 | 17.41 |
| ARCHITECTURE BUILDING | | | | | | |
| AB2 | 1 | 0.25 | 0.215 | 0.0363 | 0.600 | 16.52 |
| AB1 | 1 | 0.48 | 0.215 | 0.0697 | 1.350 | 19.36 |
| ENGG. BUILDING | | | | | | |
| EB3.1 | 1 | 0.35 | 0.215 | 0.0508 | 0.600 | 11.80 |
| EB3.2 | 1 | 0.28 | 0.215 | 0.0407 | 0.300 | 7.37 |
| EB2 | 2 | 0.40 | 0.23 | 0.0665 | 0.550 | 8.27 |
| EB1 | 2 | 0.21 | 0.23 | 0.0349 | 0.800 | 22.91 |
| EB0 | 2 | 0.38 | 0.23 | 0.0632 | 1.300 | 20.58 |
| DEGREE CANTEEN | | | | | | |
| EG1 | 1 | 0.53 | 0.215 | 0.0770 | 9.000 | 116.89 |
| EG2 | 1 | 0.52 | 0.215 | 0.0755 | 8.200 | 108.54 |
| EG3 | 1 | 0.51 | 0.215 | 0.0741 | 7.250 | 97.85 |
| EG4 | 3 | 0.35 | 0.145 | 0.0231 | 4.600 | 198.90 |
| EG5 | 3 | 0.38 | 0.145 | 0.0251 | 7.500 | 298.69 |
| EG6 | 3 | 0.38 | 0.145 | 0.0251 | 8.550 | 340.50 |
| TOTAL WEIGHT | | | = | | 80.050 kg | |

**Table 4.10 Daily waste generation at AIKTC Campus Day 10**

| | | | | | Day | 10 |
|---|---|---|---|---|---|---|
| | | | | | | |
| Floor | Bin type | Height filled ( m ) | Radius of bin ( m ) | Filled volume ( m3 ) | Weight of waste ( kg ) | Density ( kg/m3 ) |
| | | | | | | |
| DIPLOMA BUILDING | | | | | | |
| DB3.1 | 1 | 0.20 | 0.215 | 0.0291 | 0.800 | 27.53 |
| DB3.2 | 1 | 0.00 | 0.215 | 0.0000 | 2.230 | 0.00 |
| DB2.1 | 1 | 0.28 | 0.215 | 0.0407 | 0.560 | 13.77 |
| DB2.2 | 1 | 0.30 | 0.215 | 0.0436 | 0.750 | 17.21 |
| DB1.1 | 1 | 0.10 | 0.215 | 0.0145 | 1.600 | 110.13 |
| DB1.2 | 1 | 0.12 | 0.215 | 0.0174 | 0.200 | 11.47 |
| DB0.1 | 1 | 0.38 | 0.215 | 0.0552 | 1.200 | 21.74 |
| DB0.2 | 1 | 0.47 | 0.215 | 0.0683 | 0.600 | 8.79 |
| DIPLOMA CANTEEN | | | | | | |
| DBG1 | 3 | 0.37 | 0.145 | 0.0244 | 5.800 | 237.23 |
| DBG2 | 3 | 0.29 | 0.145 | 0.0192 | 7.800 | 407.04 |
| DBG3 | 3 | 0.33 | 0.145 | 0.0218 | 8.000 | 366.87 |
| PHARMACY BUILDING | | | | | | |
| PB3 | 1 | 0.27 | 0.215 | 0.0392 | 0.600 | 15.30 |
| PB2 | 1 | 0.33 | 0.215 | 0.0479 | 0.900 | 18.77 |
| PB1 | 2 | 0.41 | 0.23 | 0.0682 | 1.400 | 20.54 |
| PB0 | 2 | 0.25 | 0.23 | 0.0416 | 0.750 | 18.04 |
| ARCHITECTURE BUILDING | | | | | | |
| AB2 | 1 | 0.31 | 0.215 | 0.0450 | 0.600 | 13.32 |
| AB1 | 1 | 0.25 | 0.215 | 0.0363 | 2.450 | 67.46 |
| ENGG. BUILDING | | | | | | |
| EB3.1 | 1 | 0.38 | 0.215 | 0.0552 | 0.850 | 15.40 |
| EB3.2 | 1 | 0.45 | 0.215 | 0.0654 | 0.450 | 6.88 |
| EB2 | 2 | 0.31 | 0.23 | 0.0515 | 0.600 | 11.64 |
| EB1 | 2 | 0.15 | 0.23 | 0.0249 | 2.200 | 88.22 |
| EB0 | 2 | 0.43 | 0.23 | 0.0715 | 1.600 | 22.38 |
| DEGREE CANTEEN | | | | | | |
| EG1 | 1 | 0.52 | 0.215 | 0.0755 | 7.200 | 95.31 |
| EG2 | 1 | 0.49 | 0.215 | 0.0712 | 6.800 | 95.52 |
| EG3 | 1 | 0.53 | 0.215 | 0.0770 | 5.600 | 72.73 |
| EG4 | 3 | 0.37 | 0.145 | 0.0244 | 6.000 | 245.41 |
| EG5 | 3 | 0.35 | 0.145 | 0.0231 | 8.100 | 350.23 |
| EG6 | 3 | 0.38 | 0.145 | 0.0251 | 4.800 | 191.16 |
| TOTAL WEIGHT | | | | = | 80.440 kg | |




| | Day6 | Day7 | Day8 | Day9 | Day10 |
|---|---|---|---|---|---|
| Diploma | 29.45 | 29 | 25.25 | 27 | 29.54 |
| Degree | 53.4 | 49.5 | 53.45 | 53.05 | 50.9 |

**Figure 4.2: 5 day comparison of daily waste generation in Degree and Diploma building**

Figure 4.2 shows that the Diploma building produces average of 28 kg of waste per day and Degree building produces 53 kg of waste per day.

**Table 4.11 Daily waste generation at AIKTC Campus Day 11**

| | | | | | Day | 11 |
|---|---|---|---|---|---|---|
| | | | | | | |
| Floor | Bin type | Height filled ( m ) | Radius of bin ( m ) | Filled volume ( m3 ) | Weight of waste ( kg ) | Density ( kg/m3 ) |
| | | | | | | |
| DIPLOMA BUILDING | | | | | | |
| DB3.1 | 1 | 0.27 | 0.215 | 0.0392 | 0.700 | 17.85 |
| DB3.2 | 1 | 0.48 | 0.215 | 0.0697 | 1.600 | 22.94 |
| DB2.1 | 1 | 0.12 | 0.215 | 0.0174 | 0.200 | 11.47 |
| DB2.2 | 1 | 0.20 | 0.215 | 0.0291 | 0.400 | 13.77 |
| DB1.1 | 1 | 0.32 | 0.215 | 0.0465 | 0.900 | 19.36 |
| DB1.2 | 1 | 0.25 | 0.215 | 0.0363 | 0.750 | 0.00 |
| DB0.1 | 1 | 0.10 | 0.215 | 0.0145 | 0.150 | 10.32 |
| DB0.2 | 1 | 0.16 | 0.215 | 0.0232 | 0.200 | 8.60 |
| DIPLOMA CANTEEN | | | | | | |
| DBG1 | 3 | 0.38 | 0.145 | 0.0251 | 6.000 | 238.95 |
| DBG2 | 3 | 0.27 | 0.145 | 0.0178 | 5.800 | 325.09 |
| DBG3 | 3 | 0.31 | 0.145 | 0.0205 | 6.100 | 297.79 |
| PHARMACY BUILDING | | | | | | |
| PB3 | 1 | 0.45 | 0.215 | 0.0654 | 1.200 | 18.36 |
| PB2 | 1 | 0.10 | 0.215 | 0.0145 | 0.350 | 24.09 |
| PB1 | 2 | 0.06 | 0.23 | 0.0100 | 0.200 | 20.05 |
| PB0 | 2 | 0.42 | 0.23 | 0.0698 | 1.350 | 19.33 |
| ARCHITECTURE BUILDING | | | | | | |
| AB2 | 1 | 0.10 | 0.215 | 0.0145 | 0.400 | 27.53 |
| AB1 | 1 | 0.45 | 0.215 | 0.0654 | 1.300 | 19.89 |
| ENGG. BUILDING | | | | | | |
| EB3.1 | 1 | 0.24 | 0.215 | 0.0349 | 0.800 | 22.94 |
| EB3.2 | 1 | 0.10 | 0.215 | 0.0145 | 0.250 | 17.21 |
| EB2 | 2 | 0.18 | 0.23 | 0.0299 | 0.550 | 18.38 |
| EB1 | 2 | 0.34 | 0.23 | 0.0565 | 1.000 | 17.69 |
| EB0 | 2 | 0.48 | 0.23 | 0.0798 | 1.500 | 18.80 |
| DEGREE CANTEEN | | | | | | |
| EG1 | 1 | 0.53 | 0.215 | 0.0770 | 8.500 | 110.39 |
| EG2 | 1 | 0.50 | 0.215 | 0.0726 | 8.200 | 112.89 |
| EG3 | 1 | 0.52 | 0.215 | 0.0755 | 7.450 | 98.62 |
| EG4 | 3 | 0.28 | 0.145 | 0.0185 | 4.900 | 264.84 |
| EG5 | 3 | 0.38 | 0.145 | 0.0251 | 7.200 | 286.74 |
| EG6 | 3 | 0.38 | 0.145 | 0.0251 | 8.300 | 330.55 |
| TOTAL WEIGHT | | | | = | 76.250 kg | |

**Table 4.12 Daily waste generation at AIKTC Campus Day 12**

| | | | | | Day | 12 |
|---|---|---|---|---|---|---|
| Floor | Bin type | Height filled ( m ) | Radius of bin ( m ) | Filled volume ( m3 ) | Weight of waste ( kg ) | Density ( kg/m3 ) |
| DIPLOMA BUILDING | | | | | | |
| DB3.1 | 1 | 0.33 | 0.215 | 0.0479 | 0.750 | 15.64 |
| DB3.2 | 1 | 0.42 | 0.215 | 0.0610 | 1.100 | 0.00 |
| DB2.1 | 1 | 0.21 | 0.215 | 0.0305 | 0.600 | 19.67 |
| DB2.2 | 1 | 0.20 | 0.215 | 0.0291 | 0.550 | 18.93 |
| DB1.1 | 1 | 0.17 | 0.215 | 0.0247 | 0.400 | 16.20 |
| DB1.2 | 1 | 0.42 | 0.215 | 0.0610 | 1.300 | 21.31 |
| DB0.1 | 1 | 0.51 | 0.215 | 0.0741 | 1.400 | 18.90 |
| DB0.2 | 1 | 0.15 | 0.215 | 0.0218 | 0.250 | 11.47 |
| DIPLOMA CANTEEN | | | | | | |
| DBG1 | 3 | 0.33 | 0.145 | 0.0218 | 6.900 | 316.43 |
| DBG2 | 3 | 0.27 | 0.145 | 0.0178 | 7.250 | 406.36 |
| DBG3 | 3 | 0.38 | 0.145 | 0.0251 | 8.100 | 322.58 |
| PHARMACY BUILDING | | | | | | |
| PB3 | 1 | 0.31 | 0.215 | 0.0450 | 0.700 | 15.54 |
| PB2 | 1 | 0.28 | 0.215 | 0.0407 | 0.850 | 20.90 |
| PB1 | 2 | 0.32 | 0.23 | 0.0532 | 0.600 | 11.28 |
| PB0 | 2 | 0.45 | 0.23 | 0.0748 | 0.950 | 12.70 |
| ARCHITECTURE BUILDING | | | | | | |
| AB2 | 1 | 0.26 | 0.215 | 0.0378 | 0.800 | 21.18 |
| AB1 | 1 | 0.36 | 0.215 | 0.0523 | 0.950 | 18.16 |
| ENGG. BUILDING | | | | | | |
| EB3.1 | 1 | 0.42 | 0.215 | 0.0610 | 0.900 | 14.75 |
| EB3.2 | 1 | 0.27 | 0.215 | 0.0392 | 0.700 | 17.85 |
| EB2 | 2 | 0.30 | 0.23 | 0.0499 | 0.650 | 13.03 |
| EB1 | 2 | 0.25 | 0.23 | 0.0416 | 0.500 | 12.03 |
| EB0 | 2 | 0.43 | 0.23 | 0.0715 | 1.300 | 18.18 |
| DEGREE CANTEEN | | | | | | |
| EG1 | 1 | 0.50 | 0.215 | 0.0726 | 7.500 | 103.25 |
| EG2 | 1 | 0.49 | 0.215 | 0.0712 | 6.900 | 96.93 |
| EG3 | 1 | 0.52 | 0.215 | 0.0755 | 6.300 | 83.39 |
| EG4 | 3 | 0.38 | 0.145 | 0.0251 | 6.600 | 262.84 |
| EG5 | 3 | 0.29 | 0.145 | 0.0192 | 4.800 | 250.49 |
| EG6 | 3 | 0.38 | 0.145 | 0.0251 | 5.950 | 236.96 |
| TOTAL WEIGHT | | | | = | 75.550 kg | |

**Table 4.13 Daily waste generation at AIKTC Campus Day 13**

| | | | | | Day | 13 |
|---|---|---|---|---|---|---|
| Floor | Bin type | Height filled ( m ) | Radius of bin ( m ) | Filled volume ( m3 ) | Weight of waste ( kg ) | Density ( kg/m3 ) |
| DIPLOMA BUILDING | | | | | | |
| DB3.1 | 1 | 0.28 | 0.215 | 0.0407 | 0.500 | 12.29 |
| DB3.2 | 1 | 0.09 | 0.215 | 0.0131 | 0.100 | 7.65 |
| DB2.1 | 1 | 0.05 | 0.215 | 0.0073 | 0.050 | 6.88 |
| DB2.2 | 1 | 0.52 | 0.215 | 0.0755 | 2.000 | 26.47 |
| DB1.1 | 1 | 0.27 | 0.215 | 0.0392 | 0.450 | 6.37 |
| DB1.2 | 1 | 0.31 | 0.215 | 0.0450 | 0.650 | 13.32 |
| DB0.1 | 1 | 0.36 | 0.215 | 0.0523 | 1.500 | 28.68 |
| DB0.2 | 1 | 0.41 | 0.215 | 0.0596 | 1.000 | 13.43 |
| DIPLOMA CANTEEN | | | | | | |
| DBG1 | 3 | 0.25 | 0.145 | 0.0165 | 5.550 | 314.78 |
| DBG2 | 3 | 0.35 | 0.145 | 0.0231 | 6.250 | 263.76 |
| DBG3 | 3 | 0.38 | 0.145 | 0.0251 | 7.200 | 286.74 |
| PHARMACY BUILDING | | | | | | |
| PB3 | 1 | 0.06 | 0.215 | 0.0087 | 0.050 | 5.74 |
| PB2 | 1 | 0.48 | 0.215 | 0.0697 | 3.200 | 45.89 |
| PB1 | 2 | 0.32 | 0.23 | 0.0532 | 1.000 | 18.80 |
| PB0 | 2 | 0.03 | 0.23 | 0.0050 | 0.100 | 20.05 |
| ARCHITECTURE BUILDING | | | | | | |
| AB2 | 1 | Empty | 0.215 | 0.0000 | 0.000 | 0.00 |
| AB1 | 1 | 0.19 | 0.215 | 0.0276 | 0.500 | 18.11 |
| ENGG. BUILDING | | | | | | |
| EB3.1 | 1 | 0.04 | 0.215 | 0.0058 | 0.100 | 17.21 |
| EB3.2 | 1 | 0.19 | 0.215 | 0.0276 | 0.300 | 10.87 |
| EB2 | 2 | 0.37 | 0.23 | 0.0615 | 1.600 | 26.01 |
| EB1 | 2 | 0.05 | 0.23 | 0.0083 | 0.200 | 24.06 |
| EB0 | 2 | 0.03 | 0.23 | 0.0050 | 0.100 | 20.05 |
| DEGREE CANTEEN | | | | | | |
| EG1 | 1 | 0.53 | 0.215 | 0.0770 | 7.450 | 46.75 |
| EG2 | 1 | 0.52 | 0.215 | 0.0755 | 6.650 | 45.01 |
| EG3 | 1 | 0.49 | 0.215 | 0.0712 | 5.900 | 42.14 |
| EG4 | 3 | 0.34 | 0.145 | 0.0225 | 5.800 | 258.16 |
| EG5 | 3 | 0.38 | 0.145 | 0.0251 | 6.400 | 254.88 |
| EG6 | 3 | 0.36 | 0.145 | 0.0238 | 6.100 | 252.22 |
| | TOTAL WEIGHT | | | = | 70.700 kg | |

**Table 4.14 Daily waste generation at AIKTC Campus Day 14**

| | | | | | Day | 14 |
|---|---|---|---|---|---|---|
| | | | | | | |
| Floor | Bin type | Height filled ( m ) | Radius of bin ( m ) | Filled volume ( m3 ) | Weight of waste ( kg ) | Density ( kg/m3 ) |
| | | | | | | |
| DIPLOMA BUILDING | | | | | | |
| DB3.1 | 1 | 0.34 | 0.215 | 0.0494 | 0.900 | 18.22 |
| DB3.2 | 1 | 0.45 | 0.215 | 0.0654 | 0.400 | 6.12 |
| DB2.1 | 1 | 0.41 | 0.215 | 0.0596 | 1.250 | 20.99 |
| DB2.2 | 1 | 0.38 | 0.215 | 0.0552 | 1.300 | 23.55 |
| DB1.1 | 1 | 0.28 | 0.215 | 0.0407 | 0.400 | 9.83 |
| DB1.2 | 1 | 0.21 | 0.215 | 0.0305 | 0.200 | 6.56 |
| DB0.1 | 1 | 0.18 | 0.215 | 0.0262 | 0.150 | 5.74 |
| DB0.2 | 1 | 0.37 | 0.215 | 0.0538 | 2.000 | 37.21 |
| DIPLOMA CANTEEN | | | | | | |
| DBG1 | 3 | 0.28 | 0.145 | 0.0185 | 7.100 | 383.74 |
| DBG2 | 3 | 0.35 | 0.145 | 0.0231 | 7.000 | 302.67 |
| PHARMACY BUILDING | | | | | | |
| PB3 | 1 | 0.49 | 0.215 | 0.0712 | 2.700 | 37.93 |
| PB2 | 1 | 0.48 | 0.215 | 0.0697 | 2.500 | 35.85 |
| PB1 | 2 | 0.10 | 0.23 | 0.0166 | 0.150 | 9.02 |
| PB0 | 2 | 0.05 | 0.23 | 0.0083 | 0.200 | 24.06 |
| ARCHITECTURE BUILDING | | | | | | |
| AB2 | 1 | 0.21 | 0.215 | 0.0305 | 0.100 | 0.00 |
| AB1 | 1 | 0.36 | 0.215 | 0.0523 | 0.500 | 9.56 |
| ENGG. BUILDING | | | | | | |
| EB3.1 | 1 | 0.03 | 0.215 | 0.0044 | 0.200 | 45.89 |
| EB3.2 | 1 | 0.14 | 0.215 | 0.0209 | 0.500 | 23.90 |
| EB2 | 2 | 0.05 | 0.23 | 0.0083 | 0.200 | 24.06 |
| EB1 | 2 | 0.60 | 0.23 | 0.0998 | 10.500 | 105.26 |
| EB0 | 2 | 0.27 | 0.23 | 0.0449 | 3.800 | 84.65 |
| DEGREE CANTEEN | | | | | | |
| EG1 | 1 | 0.51 | 0.215 | 0.0741 | 11.500 | 155.21 |
| EG2 | 1 | 0.53 | 0.215 | 0.0770 | 4.100 | 53.25 |
| EG3 | 1 | 0.52 | 0.215 | 0.0755 | 3.500 | 46.33 |
| EG4 | 3 | 0.38 | 0.145 | 0.0251 | 7.500 | 298.69 |
| EG5 | 3 | 0.25 | 0.145 | 0.0165 | 5.500 | 332.94 |
| EG6 | 3 | 0.30 | 0.145 | 0.0198 | 7.200 | 363.20 |
| TOTAL WEIGHT | | | | = | 81.350 kg | |

**Table 4.15 Daily waste generation at AIKTC Campus Day 15**

| | | | | | Day | 15 |
|---|---|---|---|---|---|---|
| Floor | Bin type | Height filled ( m ) | Radius of bin ( m ) | Filled volume ( m3 ) | Weight of waste ( kg ) | Density ( kg/m3 ) |
| DIPLOMA BUILDING | | | | | | |
| DB3.1 | 1 | 0.32 | 0.215 | 0.0465 | 1.300 | 27.96 |
| DB3.2 | 1 | 0.33 | 0.215 | 0.0479 | 1.400 | 29.20 |
| DB2.1 | 1 | 0.28 | 0.215 | 0.0407 | 0.500 | 12.29 |
| DB2.2 | 1 | 0.31 | 0.215 | 0.0450 | 0.700 | 15.54 |
| DB1.1 | 1 | 0.00 | 0.215 | 0.0000 | 0.000 | 0.00 |
| DB1.2 | 1 | 0.00 | 0.215 | 0.0000 | 0.000 | 0.00 |
| DB0.1 | 1 | 0.47 | 0.215 | 0.0683 | 2.700 | 39.54 |
| DB0.2 | 1 | 0.00 | 0.215 | 0.0000 | 0.000 | 0.00 |
| DIPLOMA CANTEEN | | | | | | |
| DBG1 | 3 | 0.32 | 0.145 | 0.0211 | 6.400 | 302.67 |
| DBG2 | 3 | 0.26 | 0.145 | 0.0172 | 4.400 | 256.11 |
| DBG3 | 3 | 0.38 | 0.145 | 0.0251 | 7.200 | 286.74 |
| PHARMACY BUILDING | | | | | | |
| PB3 | 1 | 0.00 | 0.215 | 0.0000 | 0.000 | 0.00 |
| PB2 | 1 | 0.37 | 0.215 | 0.0538 | 2.000 | 37.21 |
| PB1 | 2 | 0.50 | 0.23 | 0.0831 | 4.100 | 49.32 |
| PB0 | 2 | 0.01 | 0.23 | 0.0017 | 0.150 | 90.22 |
| ARCHITECTURE BUILDING | | | | | | |
| AB2 | 1 | 0.32 | 0.215 | 0.0465 | 0.800 | 17.21 |
| ENGG. BUILDING | | | | | | |
| EB3.1 | 1 | 0.48 | 0.215 | 0.0697 | 1.250 | 17.93 |
| EB3.2 | 1 | 0.17 | 0.215 | 0.0247 | 0.400 | 16.20 |
| EB2 | 2 | 0.56 | 0.23 | 0.0931 | 3.800 | 40.81 |
| EB1 | 2 | 0.54 | 0.23 | 0.0898 | 4.200 | 46.78 |
| EB0 | 2 | 0.57 | 0.23 | 0.0948 | 6.000 | 63.31 |
| DEGREE CANTEEN | | | | | | |
| EG1 | 1 | 0.50 | 0.215 | 0.0726 | 4.400 | 60.57 |
| EG2 | 1 | 0.32 | 0.215 | 0.0465 | 2.900 | 62.38 |
| EG3 | 1 | 0.53 | 0.215 | 0.0770 | 5.400 | 70.13 |
| EG4 | 3 | 0.38 | 0.145 | 0.0251 | 10.100 | 402.23 |
| EG5 | 3 | 0.22 | 0.145 | 0.0145 | 3.700 | 254.52 |
| EG6 | 3 | 0.18 | 0.145 | 0.0119 | 1.900 | 159.74 |
| | TOTAL WEIGHT | | | = | 75.700 kg | |

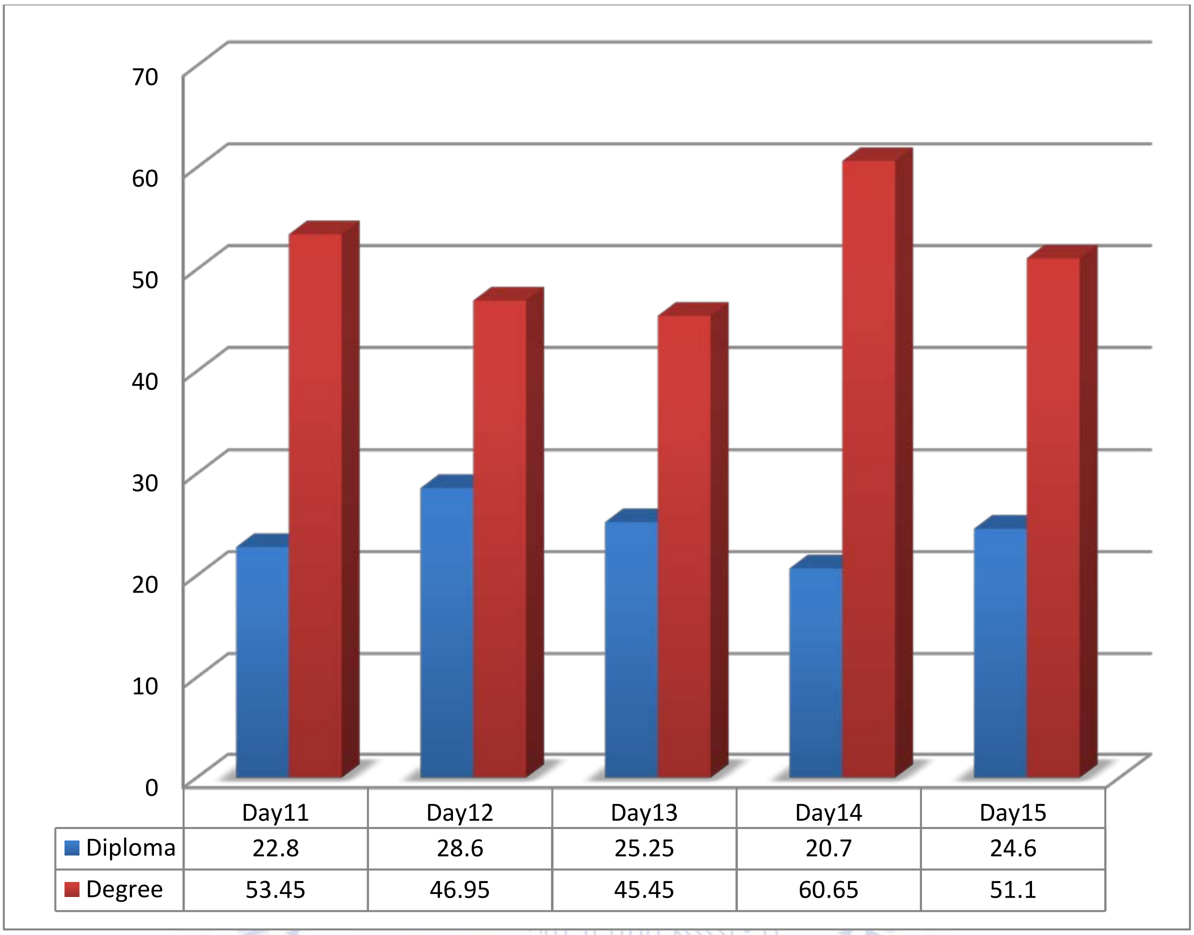



**Figure 4.3: 5 day comparison of daily waste generation in Degree and Diploma building**

Figure 4.3 shows that the Diploma building produces average of 25 kg of waste per day and Degree building produces 52 kg of waste per day.

## 4.2 Segregation of Waste

Every time 10 kg of solid waste has been collected and segregated manually to analyze the classification of waste which is present in AIKTC Campus. The components of solid waste is shown in the Table 4.16 to Table 4.18.

**Table 4.16 component of solid waste**

| After manual Segregation of waste Sample 1 | | |
|---|---|---|
| | | |
| Type of waste | | Weight in kg |
| 2nd floor Engg. Bldg | | |
| 1 | Paper | 3.30 |
| 2 | Plastic | 4.30 |
| 3 | Aluminium foil | 0.30 |
| 4 | Dust | 0.10 |
| 5 | Thermacol | 2.00 |
| | **Total** | **10.00** |

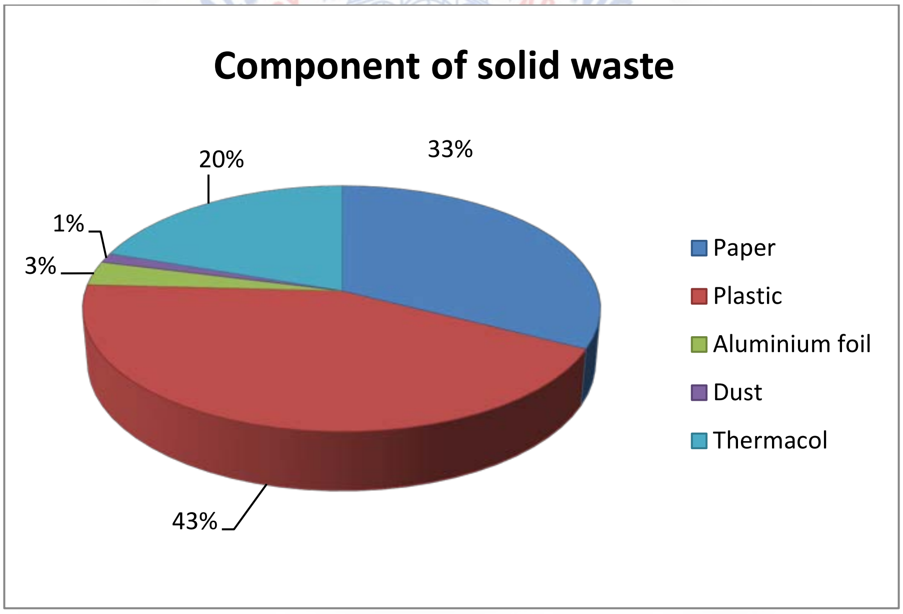



**Figure 4.4 Components of solid waste sample 1**

Figure 4.4 shows that percentage weight of component present in solid waste in sample 1, Paper - 33%, Plastic – 43%, Thermacol - 20%, Aluminum foil – 3%, Dust – 1%

This sample--1 consists of around 70 to 80 % recyclable materials.

**Table 4.17 component of solid waste**

| After manual Segregation of waste Sample 2 | | |
|---|---|---|
| | | |
| Type of waste | | Weight in kg |
| 1. Degree canteen | | |
| 1 | Paper | 3.80 |
| 2 | Plastic | 3.40 |
| 3 | Aluminum foil | 0.01 |
| 4 | Food waste | 2.80 |
| | **Total** | **10.00** |

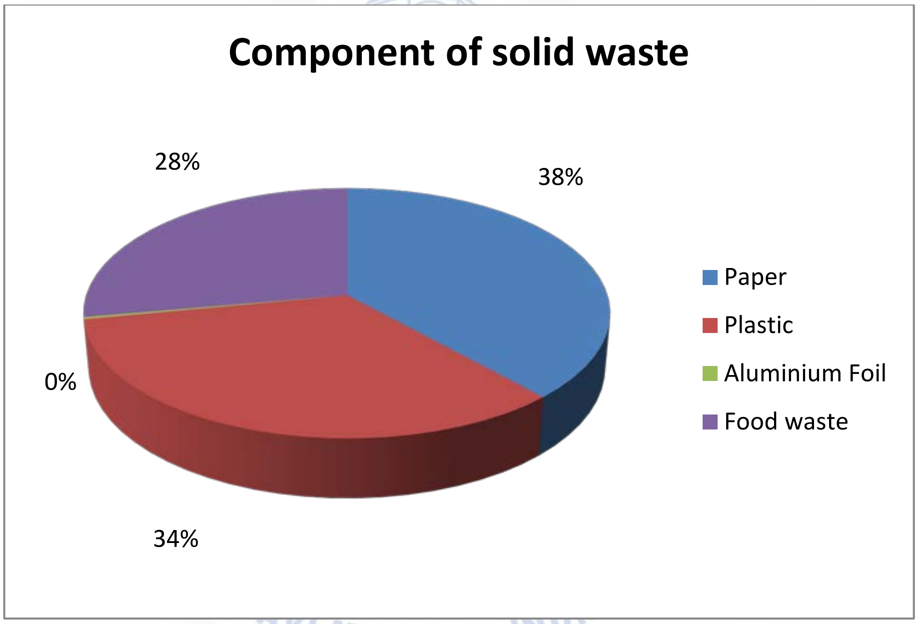



**Figure 4.5 Components of solid waste sample 1**

Figure 4.5 shows that percentage weight of component present in solid waste in sample 2, Paper - 38%, Plastic – 34%, Food waste – 28%, Aluminum foil – 0 to 1%.

This sample 2 consists of around 60 to 70 % recyclable materials and 28% of food waste can be use in bio gas production and composting.

**Table 4.18 component of solid waste**

| After manual Segregation of waste Sample 3 | | |
|---|---|---|
| | | |
| **Type of waste** | | **Weight in kg** |
| 1. Degree canteen | | |
| 1 | Paper | 1.90 |
| 2 | Plastic | 2.20 |
| 3 | Aluminum foil | 0.14 |
| 4 | Food waste | 5.70 |
| 5 | Dust | 0.15 |
| | **Total** | **11.430** |

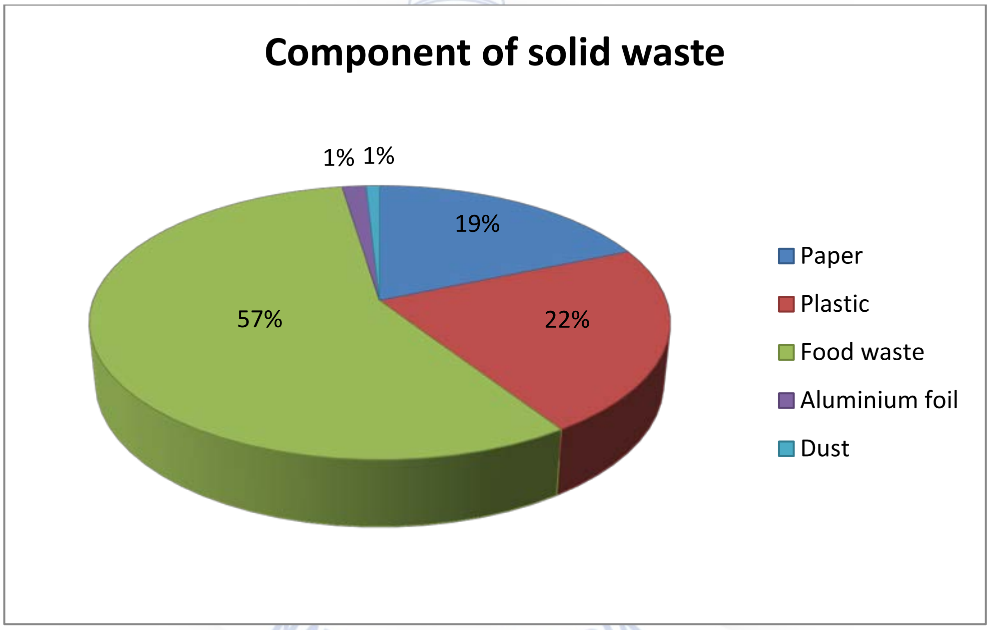



**Figure 4.6 Components of solid waste sample 1**

Figure 4.6 shows that percentage weight of component present in solid waste in sample 1, Paper - 19%, Plastic – 22%, Food waste – 57%, Aluminum foil – 1%. And dust – 1%

This sample consists of around 30 to 40 % recyclable materials and 57% of food waste can be use in bio gas production and composting.

## 4.3 Moisture Content:

The Table 4.19 shows that percentage of moisture content of 6 solid waste samples taken from different bins.

**Table 4.19 Moisture content in solid waste sample**

| Moisture Content in ( % ) | | | |
|---|---|---|---|
| Sample no | Before drying in grams | After drying in grams | Moisture Content in % |
| 1 | 34.50 | 22.00 | 36.23 |
| 2 | 34.50 | 21.50 | 37.68 |
| 3 | 23.50 | 21.50 | 8.51 |
| 4 | 27.50 | 26.00 | 5.45 |
| 5 | 30.50 | 24.00 | 21.31 |
| 6 | 30.50 | 24.36 | 20.13 |


**Figure 4.7** Before drying and after drying of sample

- Sample 1 & 2 consist of only food waste and contain the 36.23% & 37.68% of moisture.
- Sample 3 & 4 consist of only paper and plastic waste and contain the 8.61% & 5.45% of moisture.
- Sample 5 & 6 are mixed waste and contain the 21.31% & 21.13% of moisture.

## 4.4 Proposed Methodology for Disposal:

The disposal of solid waste is one of the most important process involved in solid waste management the waste may come for disposal either directly after its transportation or after processing.

### 4.4.1 Composting

An appreciable component of solid waste is organic in nature and composting a biological process (either aerobic or anaerobic) of stabilizing the organic matter to a final stable product humus. The humus is dark brown to black in color having low carbon to nitrogen (C/N) ratio and having a high retaining capacity for nutrients etc. Compost is beneficial for crop. Composting project also running by students of civil engineering

### 4.4.2 Bio Gas

Bio gas can be produced by anaerobic digestion with anaerobic organisms, which digest material inside a closed system, or fermentation of biodegradable materials. Bio gas is primarily methane ($CH_4$) and carbon dioxide ($CO_2$) and may have small amounts of hydrogen sulfide ($H2_S$), moisture and siloxanes. The gases methane, hydrogen, and carbon monoxide (CO) can be combusted or oxidized with oxygen. This energy release allows bio gas to be used as a fuel; it can be used for any heating purpose, such as cooking. Biogas from wet waste project also running by students of civil engineering

### 4.4.3 Recycling:

Recycling is the process of converting waste materials into new materials and objects. It is an alternative to "conventional" waste disposal that can save material and help lower greenhouse gas emissions (compared to plastic production, for example). Recycling can prevent the waste of potentially useful materials and reduce the consumption of fresh raw materials, thereby reducing: energy usage, air pollution (from incineration), and water pollution (from land filling)

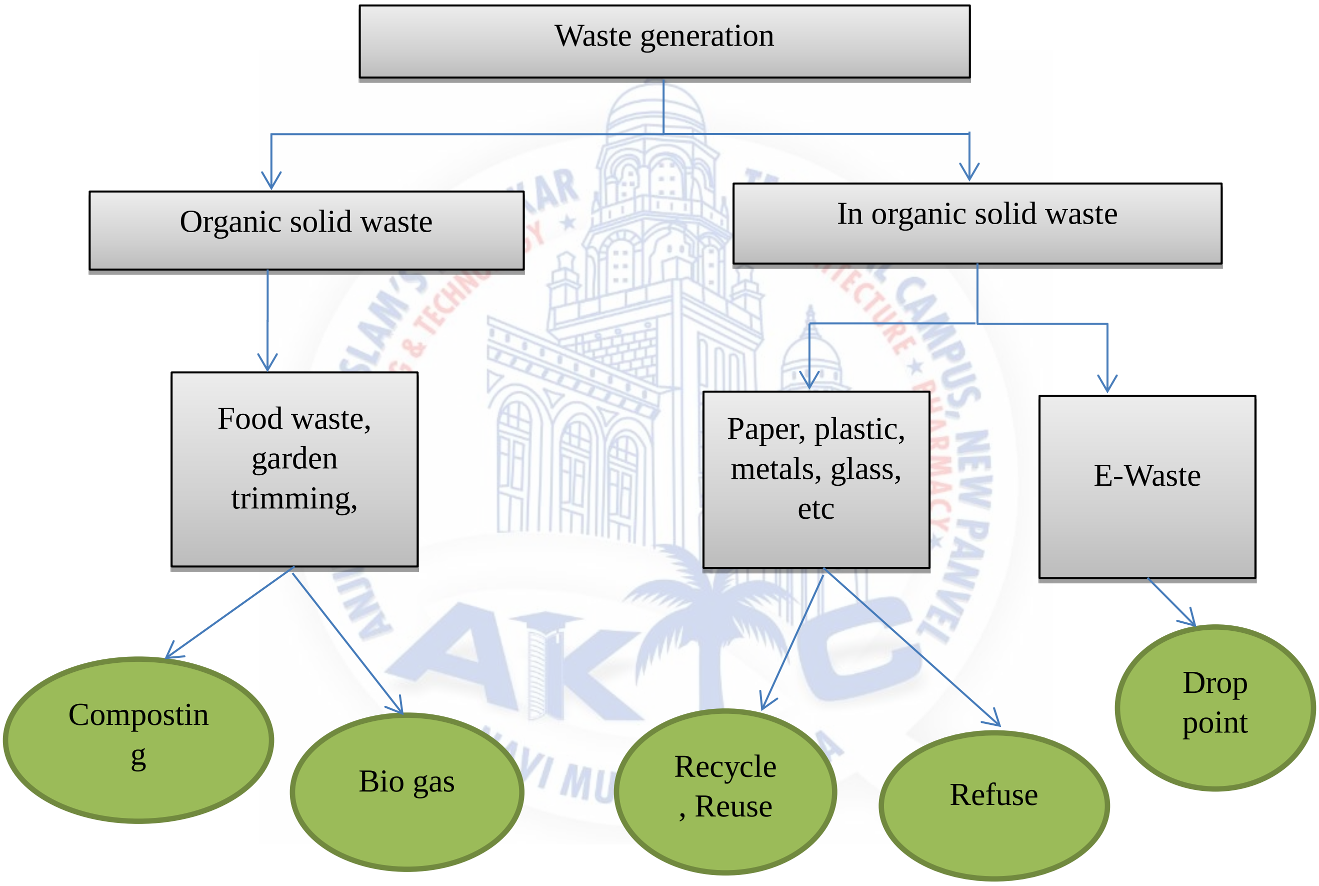



**Figure 4.8 Proposed Waste Management Plan**

# Chapter 5

# Conclusions

## 5.1 Conclusion

In our study we have conclude that there is a proper and enough collection systems is available. However solid waste handling and disposal system need attention. AIKTC Campus, the solid waste disposal system few times open dump and open burning at Campus, which can cause harm to environment and health of the students and staff, by applying proper solid waste management techniques we can minimize the waste and pollution to great extent.

An average person produces at least 0.02 kilogram of waste a day. Our solid waste is the one contributing much to the pollution.

A proper scientific approach should be adopted for processing and/or disposal of Solid Waste with material and energy recovery wherever feasible.

It is clear that improper waste management practices have a significant impact on the natural environment and sustainable development in the study area. Thus, awareness about SWM impact on sound environmental development or/and sustainable development in colleges and university of India. Sustainable use of the environmental resources and services are very important for environmental development. The purpose of this study was to analyze waste generation at campus also provide awareness and knowledge at students' level relevant to solid waste management

## 5.2 Some suggestions are:

**1.** Educate the campus on how to properly use the two types of recycling bins for UCSC's dual stream recycling system ("Paper" and "Container"). Is to Recover energy from dry wastes.

**2.** Consistent messaging to new students during orientation program. Create an educational program or tool as a requirement for all new students campus-wide that is consistently implemented across colleges and units.

## 5.3 Future Scope

1. The analysis of solid waste should be carried out throughout at various seasons to know the variation of the quality and quantity of waste in different seasons.

2. Study should be carried out to know the environmental hazards and impact from present and proposed disposal sites and methods.

3. Study should be carried to make the campus to 'Zero Waste Campus'.

4. In future study we can by proper segregation and management of E-Waste reduce the adverse effect of toxic and harmful elements present in the waste.

# ACKNOWLEDGEMENT

The satisfaction and euphoria on the successful completion of any task would be incomplete without the mention of the people who made it possible, whose constant guidance and encouragement crowned our effort with success. I am grateful to the Department of Civil Engineering, AIKTC, for giving me the Opportunity to execute this project, which is an integral part of the curriculum in B.E programme at the AIKTC, New Panvel. I would like to take this opportunity to express heartfelt gratitude for my project guide ***Dr. Shabiimam M. A,*** Assistant Professor who provided us with valuable inputs at each and every moment and also at critical to critical stages of this project execution. My special thanks to ***DR. R.B. Magar,*** Head of the Civil Engineering Department, for all the facilities provided to successfully completion of this work. We would also like to thank Prof. Wasim Shaikh, Mr. Masood Ali, Mr. Gulab Bhai and cleaning staff who helped us in various level of analyzing and support. Submitting this thesis would have been a Herculean job, without the constant help, encouragement, support and suggestions from friends. Last but not the least I would like to my gratitude to the nonteaching staff of the AIKTC.

# REFERENCES


1. Carolina Armijo de vega, Sara Ojeda Benitez, Ma. Elizabeth Ramirez Barreto, solid waste characterization and recycling potential ,*Waste Management* 28 (2008) S21-S26

2. Lester B. Lave, Chris T. Hendrickson, Member,ASCE, Noellette M. Conway-Schempf, and Francis C. McMichael, Member,ASCE, Muncipal Solid Waste Recycling Issues , *Journal of Enviroment Engineering* 1999. 125. 944-949

3. Hazra, T and Sudha, G, Solid Waste Management in Kolkata, India : Practices and Challenges *Waste Management* 29(2009) 470-478

4. N.Munilakshmi, T. Raj Kumar Reddy, D. Prasanna Kumar, N. Reena Grace, Solid Waste Management in Institutions International *Journal of Engineering Research and Development*,Volume2 ,Issue 9(August 2012)

5. Rishi,R and Rajiv, G and Ashok kumar G, Solid Management in Chandigarh, *Journal of Civil Engineering and Environmental Engineering Volume 1, Number:4, August 2014,pp 67-70*

6. Nekram Rawal , Raj Mohan Singh, and R.C. Vaishya, Optimal Management Methodology for Solid Waste in Urban Areas, *Journal of Hazardous ,Toxic, and Radioactive Waste* 2012.16:26-38

7. Avick Sil , Sunil Kumar, Waste Charecterstic and Generation, *Sustainable Solid Waste Management*

8. Chettiyappan Visvanathan Prakriti Kashyap, Public Engagement for Implementation of Waste Reduction and Recycling Policies,*Sustainable Solid Waste Management*

9. Brad Thomas, Dave Tamblyn and Brain Batez, Expert System in Muncipal Solid Waste Management Planning, *J.Urban Plann. Dev.* 1990.116:150-155

10. Albert J.Klee, New Approches to Estimation of Solid-Waste Quantity and Composition ,*j.Environ. Eng.* 1993.119:248-261

11. Amit Kumar; Manoj Datta; Arvind K.Nema;and Gunjan Rateria , Proposed Methodology for the Evaluation of Alternatives for the Remediation/Closure of Waste dumps in India , Goe-Chiocago 2016.

12. Edwin A . Korzun , *Recycling Energy Values Of Municipak Solid Waste* , Journal of Energy Engineering, Vol.117,No.3,December,1991

13. Seongwon SEo, M.ASCE; Toshiya Aramaki; Yongwoo Hwang; and Keisuke Hanaki, *Impact of Solid Waste Treatment Methods in Korea* , Journal Of Enviromental Engineering @ ASCE/January 2004/81

14. Gary K. Welshans, Solid Waste Management For Utility Reconversions , *Journal of Energy Engineering*, Vol.111,No. 1, September, 1995

15. Ammaiyappan Selvam; Jonathan Wong , Waste Management and Sustainability an Introduction , *Sustainable Solid Waste Management*

16. Kanwal Zahra; Khalid Majeed; Afzal Mahmood; and Muzaffar Asad , Impact Assessment of Community Participation in Solid Waste Management Projects in Selected Areas Of Faisalabad City , *Journal of Urbn Planning and Development@* ASCE/December 2012/319

17. William F . Ritter and Craig Dsouza , Social And Enviromental Impacts Of Waste Management Alternatives In India*:* A Critical Analysis , *World Enviromental and Resources Congress 2014*