SOLID WASTE GENERATION, SEGREGATION, AND COLLECTION: A CASE STUDY OF KITE CAMPUS, JAIPUR

[1]Gaurav Fulwaria, [2]Vishesh Kumar, [3]Piyush Kumar Singhal
[1]Assistant Professor, [2]Bachelor of technology, [3]Bachelor of technology
[1]Department of Civil Engineering
[1]Kautilya Institute of Technology and Engineering, Jaipur, India

Abstract- Solid waste management is a universal thing. Mismanagement of solid waste leads to unsanitary living conditions. Within past few years, we have been suddenly awakened to the dangers caused by the mismanagement of solid waste. Due to rapid urbanization, the situation is becoming critical as it accelerates the generation of solid waste. The problem of solid waste management (SWM) is widespread in the KITE Campus also. Therefore this study was carried out to find the issues and likeliness of solid waste in campus, Jaipur. A thorough analysis was made regarding the sources, amount of waste generated, collection and transportation system, storage, treatment and the disposal of solid waste in Campus. The data was collected through questionnaire, individual field visits, and interaction with people. Photographic evidences were also made. This study discloses that the present system of SWM in the KITE is not adequate.

Index Terms: Solid Waste Management, Insanitary Conditions, Waste disposal, data collection.

I. INTRODUCTION

Solid waste management may be defined as the control of generation, storage, collection, transfer and transport, processing, and disposal of solid wastes in a manner that is in accord with the best principles of public health, economics, engineering, conservation, aesthetics, and other environmental considerations [1]. The first objective of solid waste management is to remove discarded materials timely, from inhabited places to prevent unpleasant environment and diseases [2]. As Human Beings, it is our prime responsibility to take care of SWM, but we don't. This creates an unhygienic environment and increases chances of spreading diseases [3][4]. We can't obliterate this problem, but we can reduce it by minimizing the amount of SW by Recycling and Reusing waste materials [5]. This can be done by the various methods like Onsite Storage, Handling, Processing, and Disposal by which we can attain the proper SWM and make the environment safe and clean [6].

In India, the various state generated huge amount of waste in different amount. Per capita waste generated in the different state of India given by CPCB in 2012 vary from 0.157 kg/capita/day in Meghalaya to 0.475 kg/capita/day in Delhi [7]. This solid waste is categorized as food waste, rubbish, industrial waste, toxic materials, sanitation waste and organic matter [8]. Table1 shows per capita waste generated in tons per day in states of India given by CPCB in 2012.

Table 1 Municipal Solid waste generation rate in different states of India (CPCB,2012)

S.N	State	Waste generated in(Tons/day)	S.N	State	Waste generated in (Tons/day)
1.	Andhra Pradesh	11500	12.	Maharashtra	19204
2.	Assam	1146	13.	Manipur	113
3.	Bihar	1670	14.	Meghalaya	285
4.	Gujrat	7379	15.	Mizoram	4742
5.	Haryana	537	16.	Orissa	2239
6.	West Bengal	12557	17.	Punjab	2794
7.	Delhi	7384	18.	Pondicherry	380
8.	Himachal Pradesh	304	19.	Madhya Pradesh	4500
9.	Karnataka	6500	20.	Rajasthan	5037
10.	Kerala	8338	21.	Tamil Nadu	12504
11.	Uttar Pradesh	11585	22.	Tripura	360

II. KITE CAMPUS

Kautilya Institute of Technology & Engineering (KITE) was established in the year 2002. The campus is spread over more than 21500 sq. mtrs. area consisting 2 Boy's hostel, 1 Girl's hostel, Administrative & Academic block, Workshop section as shown in figure 1, currently with 260 people residing on this campus.

There is substantial amount of SW generated daily, but the required facilities to dispose and treat the SW are not available in the campus. The mismanagement of SW creates critical conditions which may spread diseases and creates unhygienic conditions.

III. OBJECTIVE OF STUDY

These are some objectives of this study on Waste Management in the campus.

- To specify the sources of waste generation in the KITE campus.
- To know the amount of waste generated per day in the KITE campus.
- To identify the operations being followed in KITE campus for Solid Waste Management.
- To inspect the SWM system of campus and its adequacy?
- To suggest different techniques for better management of SWM in the KITE campus.

IV. SAMPLE COLLECTION AND ANALYSIS

At first, we identified some random sites, and then we put some large bins for collection of the sample as shown in Figure 2. After one day we collected the sample from these bins and examined it by taking the weight of the sample. Then we sorted the waste into different categories according to their type and then weighed.

For the measurement of Roadside waste, we surveyed the area where the waste was spread and calculated the whole area. Then we selected some random sites and collected the samples from them with the measurement of one square meter sample area size, then calculated for the whole area with the mean of the sample collected.

Figure 2 Collection of Solid waste using large bins.

V. OBSERVATIONS

The senior supervisor is responsible for the management of waste generated in the KITE Campus. The whole area had been divided into five zones Academic section, Workshop section, Mess, Canteen, Girl's hostel and Boy's Hostel 1 & 2. There are different sources that generate the waste of various types such as Food waste, Plastics, Paper, Tin, Metal, Glass, and Dust as shown in Table 2.

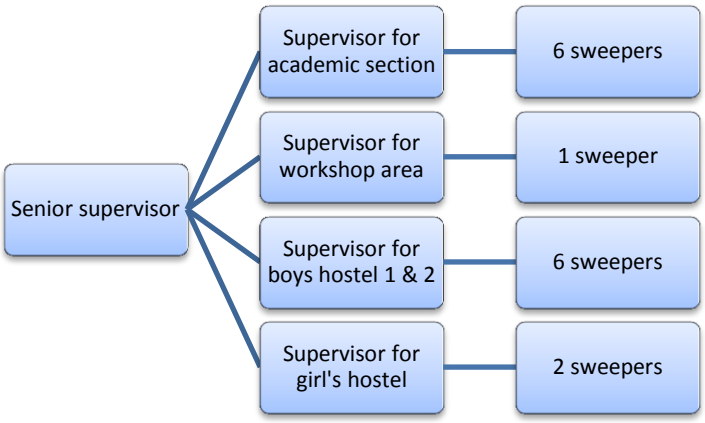
Table 2 various sources of waste generation in Campus.

S.No.	Source	Type of waste
1.	Academic	Paper, Tin, Plastic, Dust, Cardboard
2.	Mess	Food, Tin, Cardboard, Plastic, Paper, and Dust
3.	Hostel	Paper, Plastic, Metal, Dust, Cardboard
4.	Canteen	Food, Paper, Tin, Plastic(Disposal), Dust, Cardboard
5.	Roadside	Paper, Plastic, Dust, Wood, Glass

VI. COLLECTION SYSTEM

By using various methods, the SW is collected from the Campus. There are various bins provided by KITE SWM System at various locations. The whole of waste is deposits in these bins and then taken for further process. The sweepers sweep the waste in the campus, drain it and transfer the waste into the containers. There are 105 dustbins in the campus; mainly of two types-70 small plastic cylindrical bins of volume $0.02m^3$ and 35 Large Plastic Cylindrical Bins of volume 0.243 m^3. The collection of waste from these dustbins is planned in accordance with the frequency of container becoming full by the sweepers, and then this is dumped behind the college campus by using trolley for transportation. In the KITE campus, there is a senior supervisor, four supervisors and 15 sweepers currently working for the purpose of solid waste management and cleaning as in figure 3.

Figure 3 Flow chart of Staff engaged in waste management.



VII. RESULTS

Waste generation rate comes out to be 0.63 Kg per capita per day. Approximately 118.5 kg from mess activities, 10.7 kg from the hostel, 16.5 kg from the academic region,13.8 kg from the canteen and 5.48 kg from workshop area which contribute to the total of 164.98 kg solid waste per day shown in Table 3. There is additional 10 kg waste, also estimated as roadside deposited solid waste that is not collected by any collection system.

Table 3 Amount of waste generated at various places.

S.N.	Source area	Amount of waste
1.	Academic	16.5 kg
2.	Mess	118.5 kg
3.	Hostel	10.7 kg
4.	Canteen	13.8 kg
5.	Workshop area	5.48 kg
TOTAL		**164.98 kg**
6.	Roadside #	10 kg

Not added in total amount of waste generated in the campus.

According to the type of place, type of waste also varies. The composition of waste in KITE campus is given in figure 4, 5, 6,7 and 8.

Figure 4

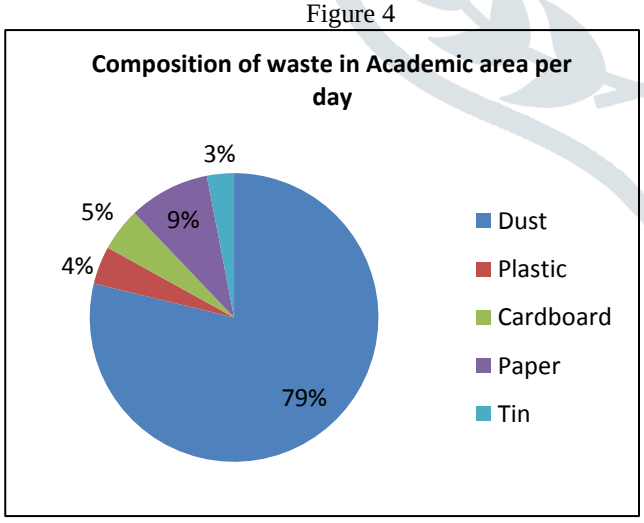


Figure 5

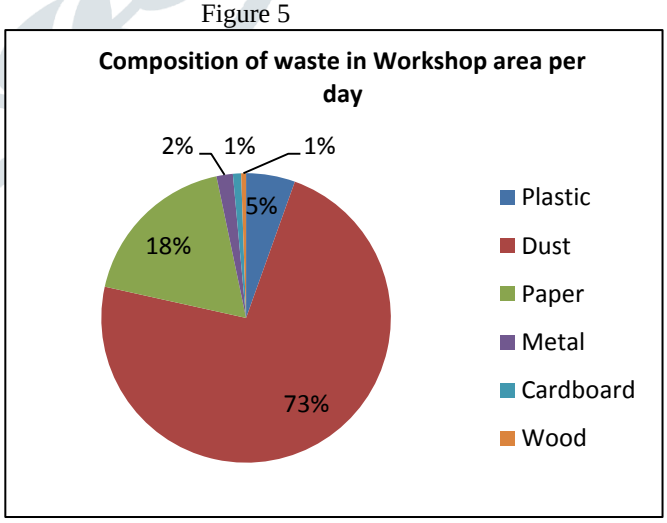


Figure 6

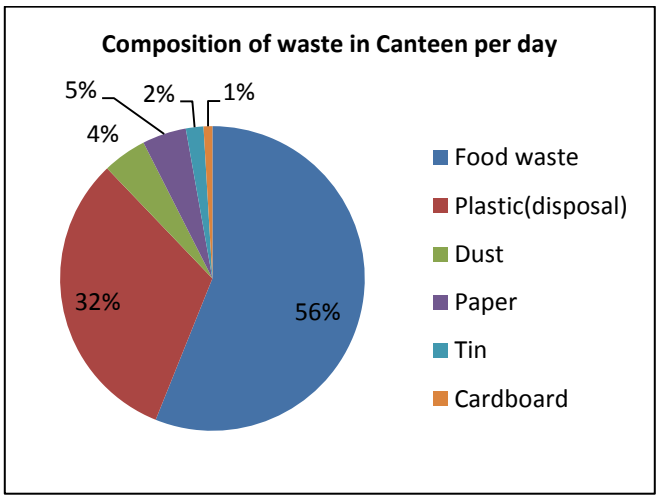


Figure 7

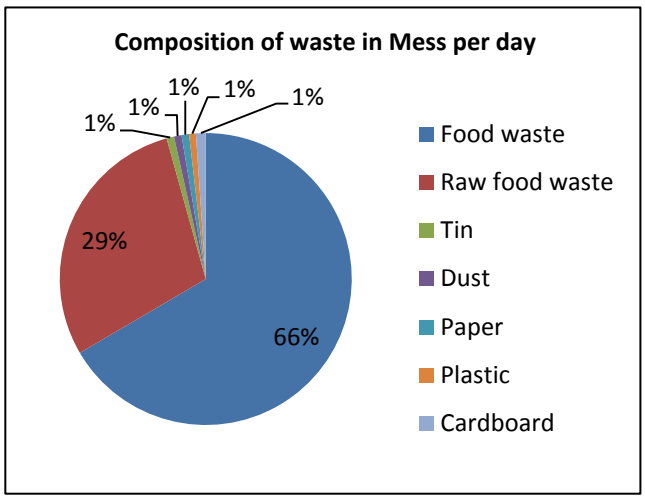
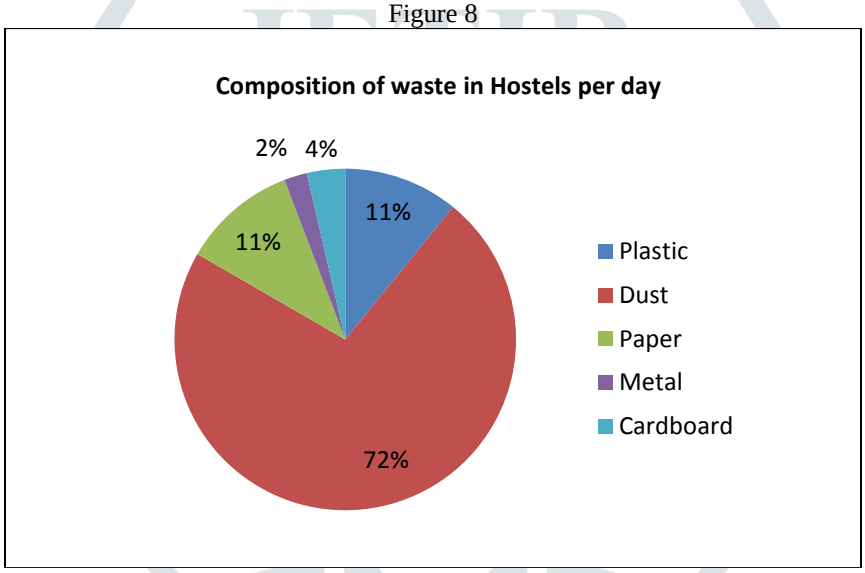


Figure 8



The SWM in the KITE Campus is not satisfactory and needs some improvement. "Recycling and waste management system should be implemented as a *Resource Management System*, not a waste management system." The solid waste has to be disposed of scientifically through sanitary landfill after recycling. Segregation of recyclable material would also leads to reduction in quantity of solid waste for final disposal. More importance should be given on sorting and collection of waste at the initial level. For this, "Three Bin System" should be followed there. For the proper management, people have to change their thinking like *"Stop Thinking Waste Management-Think Sustainable Materials Management."*

An adequate and suitable management for recyclable and biodegradable waste should be provided which can reduce the waste disposal up to 60-70 % of the total waste dispose of at present.

VIII. SUGGESTIONS

- Provide dustbins alongside the road to collect the roadside waste.
- Use "Three Bin System" for biodegradable waste, recyclable waste, and deposition waste.
- Install a biogas plant for disposing of biodegradable waste.
- Provide more dustbins in the KITE campus with covered lid.
- People should take care of cleanliness, should not through the waste here and there.
- Use trolleys for better transportation of Solid Waste to the dumping site or deposition site.

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Figure 1 KITE Campus