

Solid waste management of MNIT Campus; A Case Study

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Abstract—Solid waste generation is a worldwide phenomena depending upon the various factors viz., season of the year, frequency of collection, characteristics of population, extent of salvage & recycling, public attitude, climatic condition, legislation etc. Improper management of solid wastes causes hazards to the environment and also the people who are residing in that particular area. It is a very big challenge all over the world and it should be overcome. In India there are over 300 universities and 45000 colleges of various types. The objectives of the present studies were to evaluate the current status, identify the problems and Physical characterization of waste generated at MNIT Campus, Jaipur. The solid waste generated at MNIT Campus was not properly disposed off, only dumped un-hygienically. Methodology for this research includes: Collection of population data, existing solid waste management practices as well as physical characterization of solid waste zone wise. The major findings are: Total population of MNIT fraternity was 2883. The total amount of waste generated was around to 5.4 tons/week. Amount of organic fraction generated was 78.88% of the total waste and the remaining 21.12% of the total waste includes dry waste: cardboard, clothes, glass, leather, metal, paper, pebbles/sand, plastic, thermocol and wood.

Index Terms— Solid Waste Management, Physical Characterization

I. INTRODUCTION

Solid waste comprises of all wastages arising from human and animal activities that are normally solids and discarded as useless or unwanted i.e. precious material at wrong place. Solid waste management includes all administrative, financial, legal, planning, and engineering functions involved in the whole spectrum of solutions to problems of solid wastes (Tchobanoglous *et al.*, 1997).

In addition to waste generation from different sources, Institutions are also generating solid waste in bulk quantities. They generate large enough amounts of waste to justify individual attention. It is considered advantageous to look at solid waste management at institutional level partly because of large sizes of the institutions, and mostly because the institutions currently manage their waste themselves to a great extent. Considering the research results of the universities/institutions that carried solid waste management it directly implicates that waste generation, could be reduced, recycled and reused which further reduces the pressure of solid wastes at disposal sites. As due to studied by different scientists in different institutes, a waste recovery potential of 71% in their waste management practices, which suggests to have a solid management at every institution, because these institutions bear profound responsibilities to increase the awareness, knowledge, technologies and tools to create an environmentally sustainable future.

Objective of the study

The objectives of present study were

- Evaluation of current status and identify the problems of the MSW management in MNIT, Jaipur.
- Physical characterization of waste generated at institute level (MNIT, JAIPUR).

II. MATERIALS AND METHOD

Collection of population data:

This population data base includes student's fraternity, teaching and non-teaching staff's along with their households. Student's community data was collected from their respective residential quarters/hostels, and MNIT website whereas teaching and non-teaching staff data base was collected from Administrative section. The population data of faculty quarters collected through door to door census. The total amount of waste generated depends on the population data of the respective zone.

Existing municipal solid waste agency

The authorities of MNIT Jaipur have given the responsibility of collecting and disposing the MSW to private company SARWAN & COMPANY.

• Manpower & charges

Company has provided manpower which includes 44 workers who charges Rs.194/- per day per person from the institute. Company has charged Rs. 2, 560, 80 per month from institute solely for collection and disposal of solid waste generated in the campus. Workers are given tricycle rickshaw and tractor-trolley for collection of waste and transportation of waste to disposal site.

• Collection of waste

Sarwan & Company hired workers for collection and disposal of waste from different sites. Worker are assign for different zones, they collect the waste and put them in dustbins. There are different types of dustbins in campus as shown in figure 1



Figure 1- Different Type of Dustbin in MNIT Campus

• Waste management practice of quarters

Company has assigned 2 workers for collection of waste from quarters (total 146 quarters). One person collects the waste from quarters and other drive tricycle. Tricycle rickshaw as shown in figure 2.



Figure 2 - Collection of Waste from Quarters

• Waste Management Practice of Hostels

Waste is collecting from hostels every day basis, two people assign for cleaning the hostel and put the waste in dustbins which are placed in hostels as shown in figure 3 (a) and two people assign for collection of waste from each hostel; they come every day in afternoon and empty the dustbin in trolley as shown in figure 3 (b).



Figure 3 (a) Waste Collections inside Girls Hostel-2



Figure 3 (b) Waste Collections from Girls Hostels-2

• Disposal of waste

It is observed that waste collected from institute is not properly disposed off; there is only open dumping without any sanitization. Waste is dumping at three places as behind girls' hostel 1, behind H-type quarters and behind book bank as shown in figure 4. These dumping grounds not only affect the environment by air, water and soil pollution but also damage the property in the vicinity. The presence of moisture and rainwater leach the pollutant chemicals produced during degradation to dissolve and flow into the groundwater reserve. The dump sites virtually become a breeding ground for all kinds of diseases.



Figure 4- Disposal Site of MNIT Campus

Waste characterization

The subsequent section explains the procedures for characterization of MSW as shown below in figure 5.

• Data Collection

Data collected from all the 8 zones as mentioned above. Population data of respective zones was prerequisite for calculation of total waste generation.

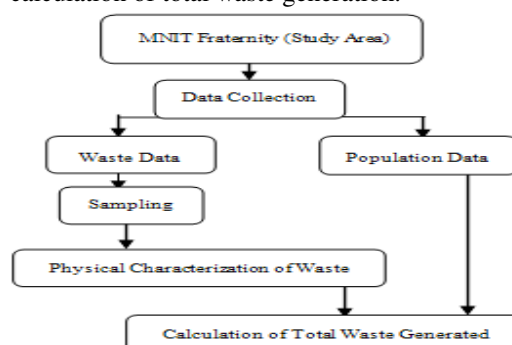


Figure 5- Flow Chart of Physical Characterization of Waste.

- *Sampling*

The following section deals with sampling sites and sampling methodology which form basis for characterization of the waste.

- *Sampling Sites*

Measurement of wastes were carried of places inside the institute, such as student's halls of residence (hostels), administration block, academic block, school, temple etc (Figure 6). The selected places were the ones that are supposed to generate major and typical sources of waste. Collection of solid waste had been done solely at the sampling stations. The entire study area was divided into 8 sub zones and few sampling points had been selected within the sub zones where sample collection should be taken and process of sampling should be carried on (Table 1). The below table depicts the zone area and their sampling stations.

Table 1 Sampling Stations according to Zone/Area

Area	Sampling Station
Academic Building	Department of Civil Engineering-5 teachers cabins
Administrative Building	Administrative building 1 (Dean academic)
Boys Hostel	5 Rooms from hostel 8
Girls hostel	5 rooms from hostel MSH
Residential building type B	5 quarters form B
Residential building type C	5 quarters from C
Residential building type D	5 quarters from D
Residential building type F	5 quarters from F
Residential building type H	5 quarters from H
Rajkiya uccha prathmic vidyalaya	Rajkiya uccha prathmic vidyalaya
Temple	Temple
Guest house	Guest house 1

- *Sampling Methodology*

The methodology of sampling varies according to the sampling stations which further depend on the area of study. Sample data collected consecutively for a period of 7 days which further be extrapolated to find out total waste generation from that particular zone. Dustbins/plastics bags provided to the concerned residents and asked to discharge their dry and wet wastages separately. The collection and

transportation of wastes from the concerned sampling points had been carried out daily on regular basis. The collected wastes from sampling points transported to storage points where physical characterization was done. The total quantity of waste so collected was thoroughly mixed and subsequently reduced by the method of quartering till samples of such size was obtained. The sample so obtained was subjected to physical analysis.

- *Characterization technique*

The collected sample is physically sorted out on a sorting platform into various ingredients such as paper, glass, plastics, organic, inorganic wastes, etc. The individual components were stored in bins and weighed. The weights were expressed as a percent of the original sample on a wet weight basis.

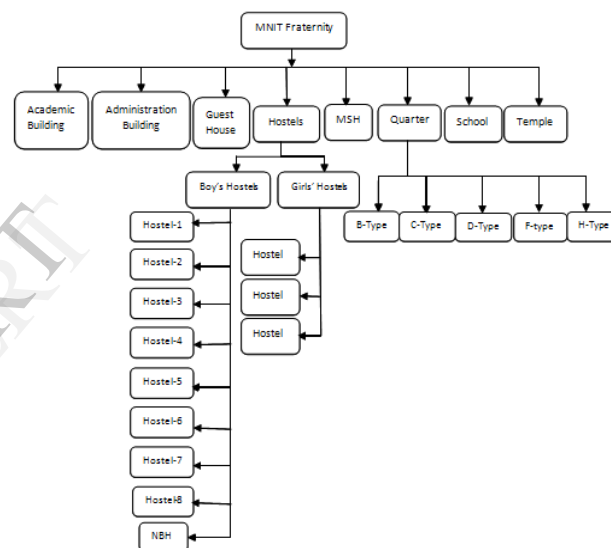


Figure 6 - Sampling area

III. RESULT AND DISCUSSION

Evaluation of current status

- *Population Data*

Population of the entire study area has been calculated and results correlating to the population have been explained in further section. Total population of MNIT fraternity was 2681.

Table 2 Population data of MNIT campus

Name of building	Population
Quarters	441
Hostels	1680
Academic building	220

Administrative section	52
School	196
Married scholars	21
Estate section	41
Central library	10
Caretaker office	20

Total Waste Generated from MNIT Fraternity

The total amount of waste generated from each building is calculated, and amount of waste generated depends directly on the population of that building. The total amount of waste generated from the entire institute per week was around 5394.26 Kg/wk which is equivalent to 5.4 tons.

Total Waste Generated from different Buildings of MNIT Fraternity

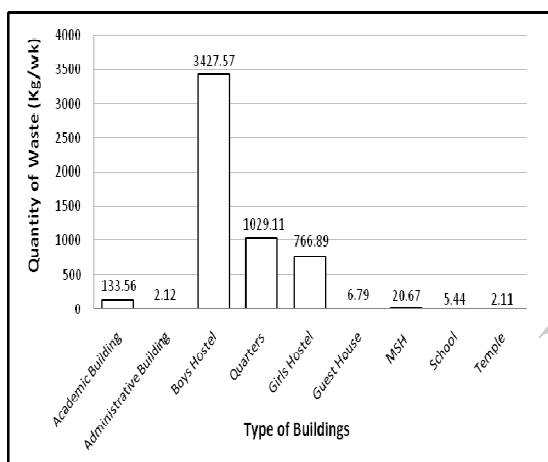


Figure 7 Quantity of Waste from each Building

From the figure 7 it was observed that maximum contribution of the waste was from boys' hostel which was 63.54% (3427.57 Kg/wk). It was because of maximum number of students. Rest contributed by academic building, administration building, girls' hostel, guest house, MSH, quarters, school and temple which is 37.46% (1966.69 Kg/wk).

Different type of Waste Generated from MNIT Fraternity

Different types of waste, their amount and percentage from total waste is calculated. Type of waste and percentages of waste generated from the MNIT fraternity is shown below in figure 8.

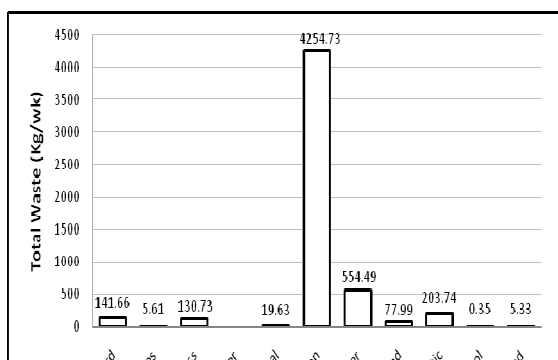


Figure 8 Quantity of Waste generated against each type of Waste

From the analysis, it was found that amount of organic fraction was maximum which was 78.88% of the total waste (4254.73 Kg/wk) and the remaining 21.12% of the total waste (1139.54 Kg/wk) includes dry waste: cardboard, clothes, glass, leather, metal, paper, pebbles/sand, plastic, thermocol and wood.

Total Organic Waste Generated from MNIT Fraternity

Figure 9 shows amount of total organic fraction from different type of buildings.

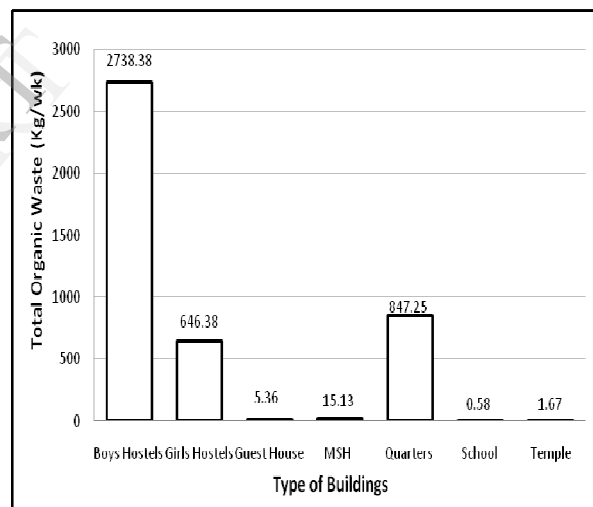


Figure 9 Quantity of Organic Waste against each type of Building

Organic waste included cooked waste, vegetable waste and garden trimming. Total organic waste generated was from boys' hostel, girls' hostel, guest house, married student hostel, quarters, school and temple and was 78.88% (4254.75 Kg/wk) of the total waste generated from MNIT Fraternity.

From the figures 9 it was observed that maximum amount of organic waste was generated from boys' hostel which was 64.36% (2738.38 Kg/wk) because the population of the boys' hostel was too high. Rest of the organic fraction was contributed by girls' hostels, guest house, MSH, quarters, school and temple which was 35.64% (1516.37 Kg/wk). Generation of organic waste from girls' hostels, MSH and

quarters was due to cooking practices at regular basis while Generation of organic waste from guest house was due to the garden trimming not due to cooking practices. Generation of organic waste from temple was because of the offering flowers to god by priest and devotees.

Total Dry Waste Generated from MNIT Fraternity

Dry waste component includes cardboard, clothes, glass, leather, metal, paper, pebbles/sand, plastic, thermocol and wood.

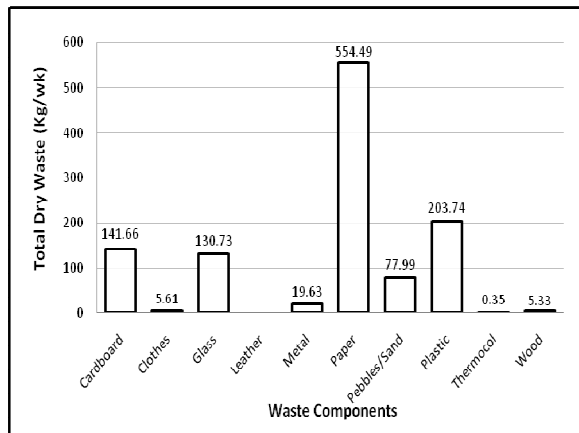


Figure 10 Quantity of Dry Waste against each type of Waste

From the figures 10 it was observed that among all the dry waste components paper was the major components which was 10.28% (554.49 Kg/wk). Rest of the dry waste was contributed by cardboard, clothes, glass, leather, metal, paper, pebbles/sand, plastic, thermocol and wood which was 10.85% (585.05 Kg/wk) of the total dry waste.

IV. CONCLUSIONS

Current status of MNIT Jaipur

- It is observed that the population in the hostels and quarters are higher when compared to rest of the buildings in the institute as shown below
Hostels>Quarters>Academic Building> School> Administrative Building>Estate section > Married scholars'> Caretaker office> Central library.
- There is no sufficient number of dustbins present in the campus as per the amount of waste generated and no proper arrangement of dustbins in academic building.
- Dustbins are not provided on the roadside which is very essential; due to it students throw the waste such as rappers, used packets of lassie, chach, kurkure, chips etc.
- Segregation of waste is not done at source level.

- It is observed that waste generated at MNIT campus is dumped inside the campus.

Waste characterization data

- Total waste generated from MNIT campus is 5.4 tons/wk. Waste generation data is as follows
Boys Hostel>Quarters>Girls Hostel>Academic Building>Married Scholars Hostel > Guest House>School>Administrative Block>Temple.
- Increasing order of % of total waste
Organic waste> Paper> Cardboard> Glass> Pebble/sand> Metal>Textile>Wood>Thermocol.
- The amount of waste generated from hostels is in the following increasing order
Hostel No.-7> Girls Hostel No.-1> Hostel No.-6> Hostel No.-3> Hostel No.-2> Hostel No.-5> Hostel No.-1> Hostel No.-4> New Boys Hostel> Hostel No.-1=Ganga> Girls Hostel No.-2.
- The increasing order of municipal solid waste disposed from the faculty quarters is as follows
Type D>Type F>Type H>Type B>Type C.
- The type of waste generated from the Academic and Administrative buildings are of recyclable nature.
- Academic building
Paper>Cardboard>Pebble/sand>Plastic.
- Administrative building
Paper>Cardboard>Plastic>Pebble/sand>Thermocol.
- Waste generation from married scholar's building is similar to other residential quarters and the as follows
Organic waste> Plastic> Paper> Cardboard> Pebble/sand> Metal.
- Waste generation from school (Rajkiya uccha prathmik vidyalaya) is less when compared to other buildings. The waste generated from school is as follows
Pebble/Sand>Paper>Organic fraction> Plastic> Cardboard> Thermocol.
- Waste generated from Guest house varies according to number of guests present at that time. Waste generated from guest house is as follows
Organic fraction> paper> Thermocol> Plastic> Pebble/Sand>Textile>Glass.
- Waste generated from temple also varies according to days, as on Monday waste generation is more compared to other days.
Organic fraction> Cardboard> Pebble/Sand> Paper>Plastic.

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