

# Solid Waste Collection and Segregation: A Case Study of MNIT Campus, Jaipur

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*Abstract—Solid waste management is a worldwide phenomenon. Improper management of solid waste (SW) causes hazards to inhabitants. It is a big challenge all over the world for human beings. The problem of solid waste management (SWM) is also prevailing in the urban environment of MNIT Campus. Therefore the present study was taken to find out the problems and prospects of solid waste MNIT, Jaipur. A detailed investigation was made regarding the methods of practices associated with sources, quantity generated, collection, transportation, storage, treatment and disposal of solid waste in MNIT Campus. The data concerning to SWM in MNIT Campus was obtained through questionnaire, individual field visit, and interacting with people. Photographic evidences were also made about generation, storage, collection, transportation, treatment and disposal of Solid Waste. This study reveals that the present system of SWM in MNIT is not satisfactory Solid Waste Management.*

**Key word:** Solid Waste Management, Urban Environment, Individual Field Visit, Photographic Evidence.

## I. INTRODUCTION

Solid waste management is an integral part of urban and environmental management, like most of other infrastructural services has come under great stress, consider low priority areas, solid waste management was never taken up seriously either by public or by concerned agency or authorities and now the piled up waste is threatening our health, environment and well-being (Chouhan and Reddy 1996, Mazumdar 1994 & Yadav et al. 2009). Waste minimization is a methodology used to achieve waste reduction, primarily through reduction at source, but also including recycling and re-use of materials. The benefits of waste minimization are both environmental and financial and wide in their coverage. (Dhande et al. 2005). To implement proper waste management, various aspects have to be considered such as: Source reduction, Onsite storage, Collection & transfer, Processing, and Disposal (Rajput et al. 2009). Solid waste may be defined as generation of undesirable substances which is left after they are used once. They cannot be reused directly by the society for its welfare because some of them may be hazardous for human health. Covering of various vegetables, fruits and cooked material facilitate proliferation of various group of microbial flora, which may be pathogens. (Shivashankara et al. 2005 & Macwan 2003)

There are many categories of Solid Waste such as food waste, rubbish, commercial waste, institutional waste, street sweeping waste, industrial waste, construction and demolition waste, and sanitation waste. Solid Waste contains recyclables (paper, plastic, glass, metals, etc.), toxic substances (paints, pesticides, used batteries, medicines),

compostable organic matter (fruit and vegetable peels, food waste) and soiled waste (blood stained cotton, sanitary napkins, disposable syringes) (Jha et al., 2003, Reddy & Galab, 1998, and Khan, 1994). The quantity of Solid Waste generated depends on a number of factors such as food habits, standard of living, degree of commercial activities and seasons. Data on quantity variation and generation are useful in planning for collection and disposal systems. In India the different state generated huge amount of waste in different amount, per capita waste generated in different state of India given by CPCB in 2000 under status of MSW generation, collection, treatment, and disposal vary from 0.157 kg per capita per day in Meghalaya to 0.475 kg per capita per day in Delhi shown in Table I.

**TABLE I: Municipal Solid Waste Generation Rate in Different States of India (CPCB, 2000)**

S. N.	State	Per capita waste generated (kg/day)	S. N.	State	Per capita waste generated (kg/day)
1	Andhra Pradesh	0.364	12	Maharashtra	0.378
2	Assam	0.223	13	Manipur	0.201
3	Bihar	0.280	14	Meghalaya	0.157
4	Gujarat	0.451	15	Mizoram	0.296
5	Haryana	0.276	16	Orissa	0.336
6	West Bengal	0.321	17	Punjab	0.312
7	Delhi	0.475	18	Pondicherry	0.295
8	Himachal Pradesh	0.427	19	Madhya Pradesh	0.316
9	Karnataka	0.376	20	Rajasthan	0.355
10	Kerala	0.393	21	Tamil Nadu	0.467
11	Uttar Pradesh	0.381	22	Tripura	0.210

## II. MNIT CAMPUS

MNIT is one of the 20 NIT's deemed university on June 26, 2002 is established as MREC (Malaviya Regional College of engineering) in 1963 as a joint venture of government of Rajasthan presently function as centrally funded institutions. Spread over 325 Acres area consists of Nine Boys Hostel, Five Girls Hostel, academic section, and residential section for faculty shown in Fig.1, currently with approximate 5,000 peoples residing in this campus.

The management of SW is going through a critical phase, due to the unavailability of suitable facilities to treat and dispose of the larger amount of SW generated daily. Anthropogenic activities in campus generate large quantities of wastes posing a problem for their disposal. Improper disposal leads to spreading of diseases and unhygienic condition besides spoiling the aesthetics.

### III. OBJECTIVE OF STUDY

There is following different objectives of my study on solid waste management in the MNIT Campus.

- 1) To characterized the waste generated and source of waste generation in MNIT Campus
- 2) To identify the solid waste management practices existing in campus.
- 3) To examine the current solid waste management system of campus and describe, it is sufficient?
- 4) To suggested about some different practices for better management of solid waste management in MNIT Campus

### IV. LAYOUT OF SURVEY STRATEGY

1. Identify the survey area (by maps available on internet)
2. Collect information about
  - a. Different sections of campus (from institute administration)
  - b. Their location and size (by visiting)
  - c. Visited the campus
3. Divided the campus in to different zone according to my study purpose
  - a. Academic and departmental area
  - b. Residential area, and
  - c. Hostels and messes
4. Collect the information about the staff for SWM (by questioner)
5. Collect information about the solid waste management activities in campus through
  - a. Questionnaire with staff for SWM
  - b. Questionnaire with residing peoples, and
  - c. Individual field visit
6. Sample collection and examine the waste buy
  - a. Visual method
  - b. Sort and weigh method
  - c. Grid method
7. Analysis of observation
8. Result and discussion
9. Conclusion and suggestions

### V. SAMPLE COLLECTION AND ANALYSIS

The solid waste from the different random site was collected, from bins provided by existing system of waste management. For the purpose of sample collection I put some large poly bags Shown in Fig.2 (a and b) in the bins selected for sample collection, there for the sample was collected in these bags was taken out and examine by taking weight of that bag. Then the waste is take out from these bags and sorted in to different categories and weighted for measurement of composition of particular type of waste. And for the measurement of the amount of road side waste I, take survey of the area of waste deposition and calculate the area (by using GIS software) where the waste is spread. Then I select some sample collection site and randomly collect the sample of waste form these areas with the measurement of one meter of one

meter sample area size. Then calculate for whole area with the mean of the sample collected.



Fig.2 (a) Bin with poly bag Fig.2 (b) Packed poly bag

### VI. OBSERVATIONS

Mr. Neeraj senior supervisor is responsible for the management of sold waste generated in the MNIT Campus. His administration has been divided Campus in to four zones Academic section and residential area, Girl's hostels, Boys hostel no. 1 to 8 and Aurobindo hostel.

In this campus there is different source area that generates the waste of different type such as Food waste, Plastics, Paper, Tin, Rubber, Metal, Glass, Dust, Textile, Leather, and Garden Trimming shown in Table II.

TABLE .II: Major Sources of Solid Waste Generation in MNIT Campus.

S.N.	Source	Type of Waste
1	Mess	Food, Tin, Plastic, Paper, and Dust.
2	Residential	Food, Plastics, Paper, Tin, Rubber, Metal, Glass, Dust, Textile, Leather, Garden Trimming.
3	Academics	Paper, Plastic, Cardboard, Dust, Garden Trimming.
4	Hostel	Glass, Paper, Tin, Plastic, Leather, Dust, Cardboard.
5	Road side	Glass, Plastic, Paper, Wood.

### VII. COLLECTION SYSTEM

The solid waste is collected from different sources/establishment by various methods. The solid waste management activity in MNIT consists of wastes generator throwing the waste into the different types of bins provided by the MNIT waste management system at different locations fig.3, 4, and 5. The sweepers sweep the road and drain and transfer the waste into the bins. There are 236 dust bins of different types 130 small plastic rectangular, 50 big plastic cylindrical and 56 cement concrete are placed in MNIT. Three types of dust bins are used. These are Large Plastic Cylindrical Bins of volume 0.339 m<sup>3</sup>Fig. 4, Cement Concrete Bins of volume 2 m<sup>3</sup>Fig. 5, and Small Plastic Rectangular Bins of volume 0.243 m<sup>3</sup>Fig.3.

The collection of waste from these dust bins is planned in accordance with frequency of container becoming full

by the by sweepers to the larger cemented bins constructed at different places which his finally collected by the collection tractor came on every second day. The present location of dust bins and the waste collection point have been classified into daily collection (A type), weekly twice collection (B type) and weekly once collection (C type). In the MNIT campus one senior supervisor, 4 supervisors and 80 sweepers currently working for the Purpose of solid waste management and cleaning shown in Fig.6.



Fig. 3 & 4: Small Plastic Rectangular Bin and Large Plastic Cylindrical.



Fig.5: Cemented Bin in MNIT Campus

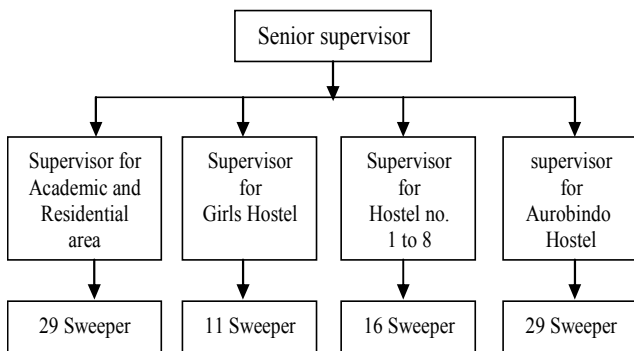


Fig.6: Flow Chart of Staff Engaged In Solid Waste Management in MNIT

**VIII. TRANSPORTATION**

Transportation of solid waste collected to larger bins by sweepers is carried out properly by a tractor at each second day Lifting of garbage is done manually. The waste collected from the roads and bins is directly transported to the final dumping site The refuse vehicles have to travel outside the campus at a particular dumping site or dump the waste collected in the lower region of campus for filling this lower region to take it in level. The tractors carrying waste are not covered or partially covered during the journey and waste tends to spill on the roads.

Most often workers are not provided with protective hand gloves and shoes so they are directly expose to the

waste. Protective measures are necessary to avoid contracting skin allergies and respiratory diseases .The loading and unloading of waste is done through mechanical system reducing direct contact of worker with the wastes.

**IX. RESULTS AND DISCUSSION**

Waste generation rates works out to be 0.40 Kg per capita per day. Approximately 700 kg/day waste is generated from the residential area, 300 kg. From mess activities, 700 kg from hostel and 300 kg from academic region which contribute to the total 2000 kg solid waste per day shown in Table III.

There is additional 400 kg waste also estimated as road side deposited solid waste that is not collected by any collection system.

TABLE III: The Various Waste Generating Places in Campus

S.N.	Source Area	Amount of Waste
1	Mess	300 kg
2	Residential	700 kg
3	Academics	300 kg
4	Hostel	700 kg
	<b>TOTAL</b>	<b>2000 kg</b>
5	Road side *	400 kg

\* Not included in total amount of waste generated in campus

**X. CHARACTERISTICS OF SOLID WASTE**

The quantity and characteristics of solid waste vary from place to place. Factors that influence the quantity and Compositions are the different activity areas for waste materials. The typical composition of solid waste of MNIT is given in Table IV, V, VI and VII & Figure 6, 7, 8 and 9.

TABLE IV: Composition of Solid Waste Generated in MNIT Academic Area per Day

S. N.	Type of Waste	Calculated Amount	Percentage
1	Food waste	0 kg	-
2	Plastic	33 kg	10 %
3	Paper	46 kg	15 %
4	Glass	34 kg	18 %
5	Cardboard	31 kg	9 %
6	Leather	9 kg	3 %
7	Dust	22 kg	7 %
8	Garden trimming	36 kg	11 %
9	Tin	19 kg	6 %
10	Wood	46 kg	13 %
11	Metal	24 kg	8 %
	<b>TOTAL</b>	<b>300 kg</b>	<b>100 %</b>

TABLE V: Composition of Solid Waste Generated in Residential Area of MNIT Campus per Day

S. N.	Type of Waste	Calculated Amount	Percentage
1	Food waste	250 kg	36 %
2	Plastic	50 kg	7 %

3	Paper	37 kg	5 %
4	Glass	58 kg	8 %
5	Cardboard	24 kg	4 %
6	Leather	14 kg	2 %
7	Dust	17 kg	3 %
8	Garden trimming	145 kg	20 %
9	Tin	21 kg	3 %
10	Wood	28 kg	4 %
11	Metal	56 kg	8 %
	<b>TOTAL</b>	<b>700 kg</b>	<b>100 %</b>

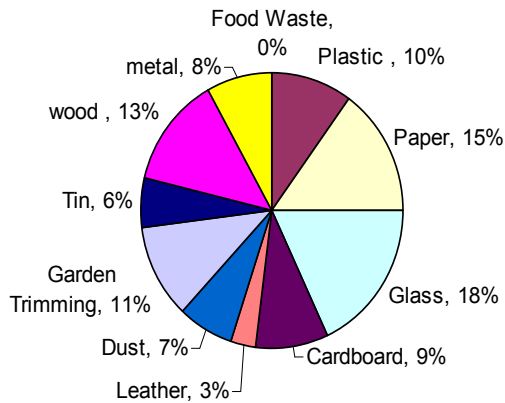


Fig.7: Composition of waste in Academic Area

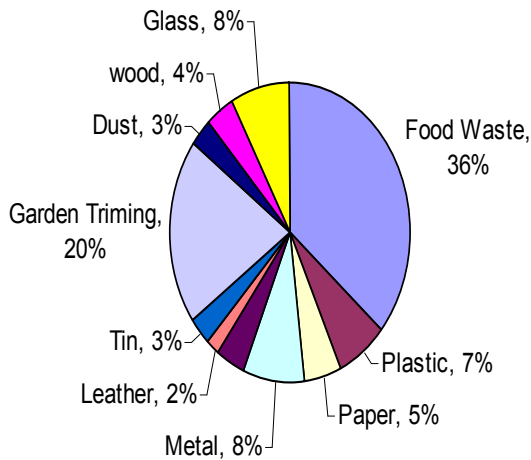


Fig.8: Composition of waste in Residential Area

TABLE VI: Composition of Solid Waste Generated In Hostels of MNIT per Day

S. N.	Type of Waste	Calculated Amount	Percentage
1	Food waste	178 kg	26 %
2	Plastic	84 kg	12 %
3	Paper	98 kg	14 %
4	Glass	105 kg	15 %
5	Cardboard	63 kg	9 %
6	Leather	21 kg	3 %
7	Dust	35 kg	5 %
8	Garden trimming	35 kg	5 %
9	Tin	42 kg	6 %
10	Wood	21 kg	3 %
11	Metal	14 kg	2 %

	<b>TOTAL</b>	<b>700 kg</b>	<b>100 %</b>
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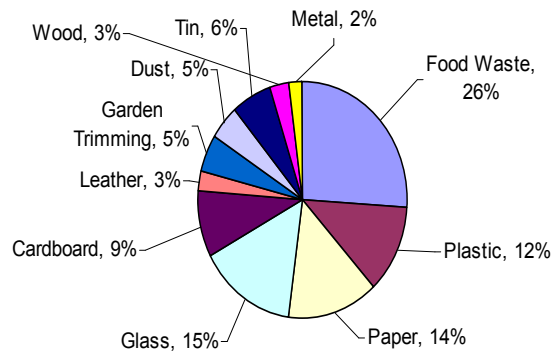


Fig.9: Waste Composition in Hostel Area

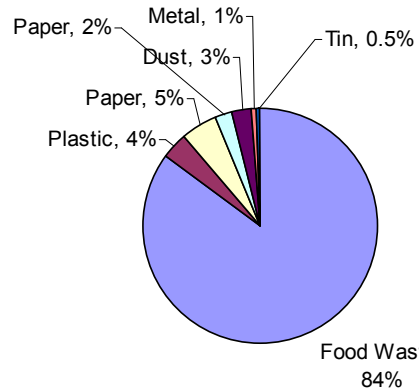


Fig.10: Waste Composition in Mess & Canteen

TABLE VII: Composition of Solid Waste Generated In Mess and Canteen of MNIT Campus per Day

S. N.	Type of Waste	Calculated Amount	Percentage
1	Food waste	255 kg	85 %
2	Plastic	12 kg	4 %
3	Paper	15 kg	5 %
4	Glass	6 kg	2 %
5	Cardboard	-	0 %
6	Leather	-	0 %
7	Dust	9 kg	3 %
8	Garden trimming	-	0 %
9	Tin	1.5 kg	0.5 %
10	Wood	-	0 %
11	Metal	1.5 kg	0.5 %
	<b>TOTAL</b>	<b>300 kg</b>	<b>100 %</b>

### XI. CONCLUSION

The solid waste management in MNIT appears to be inadequate and needs up gradation. The solid waste has to be disposed of scientifically through sanitary landfill and recyclable portion of the waste should be salvaged. Segregation of recyclable material would also leads to reduction in quantity of solid waste for final disposal. A system approach needs to be adopted for optimizing the entire operation of SWM encompassing segregation at source, timely and proper collection, transportation routes and types of vehicles and development and proper operation of sanitary landfill site.

More emphasis needs to be laid on segregation and collection of waste at door step. Segregation of recyclable material from mixed waste not only is Tedious but also wasteful, therefore the residents should be sensitized towards the importance of segregation of wastes at source. Rather than considering the solid waste simply as residue to be thrown away, it should be recognized as resource materials for the production of energy, compost and fuel depending upon the techno-economic viability, local condition and sustainability of the project on long term basis.

A better management for recyclable and biodegradable waste utilization provides the facility to reduce the waste disposal up to 60-70 % of the total waste dispose at present.

## XII. SUGGESTIONS

- 1) To use Three bin system different for biodegradable waste, recyclable waste and deposition waste.
- 2) To use Trolleys for the collection of road side waste and collection of residential waste.
- 3) Provide dustbins at different locations along side of road to collect the road side waste.
- 4) To use the biodegradable waste for the land filling or running of Biogas plant Existing in MNIT campus or as vermi-composting.
- 5) To create three partitions in cemented Bins for separated disposal of different type of waste at the source level.

To suggested the sweepers to segregate the different type of waste at the collection site before final transfer for the disposal.

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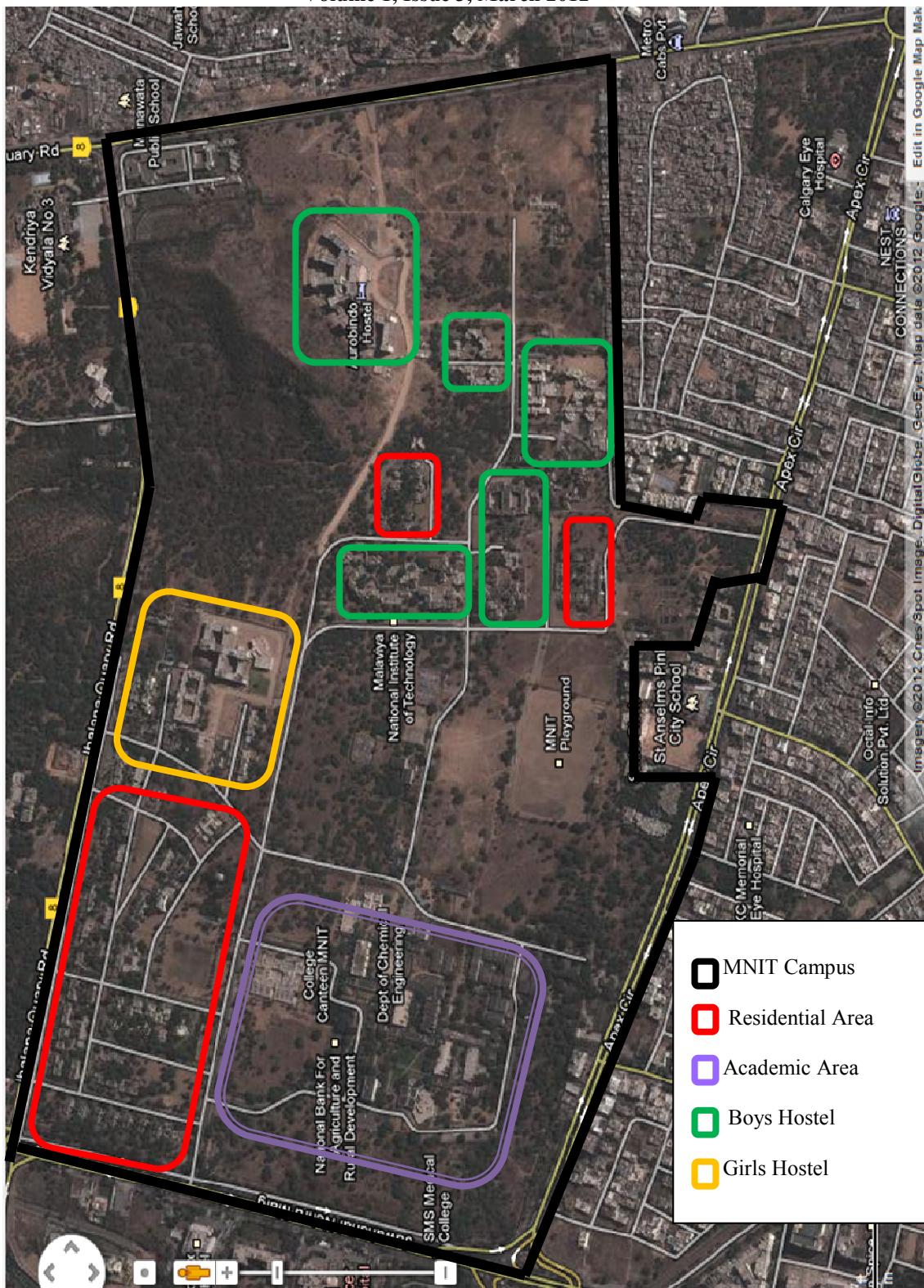


Fig.1 MNIT campus