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Case Study of Institutional Solid Waste in MDU Rohtak

Amit Kumar [1], Vineet Kumar [1], Shubham [2], Gourav [2]

[1] *Assistant Professor, Department of Civil Engineering, U.I.E.T, M.D.U, Rohtak*
[2] *B.Tech final year student, Department of Civil Engineering, U.I.E.T, M.D.U, Rohtak*

Abstract

ISW is a significant environmental problem that the globe is currently confronting. In this review study, the sources, composition, generation, and administration of ISW are all thoroughly analyzed in relation to the current level of knowledge. The study conducts a critical analysis of the several management techniques used to deal with ISW, such as recycling, composting, burning, and landfilling. The paper identifies the drawbacks and difficulties of each of these approaches and investigates the possibilities for cutting-edge technologies like waste-to-energy and biofuels to offer long-term solutions for ISW management. The assessment also takes into account the necessity of increased public knowledge and involvement in recycling and waste minimization activities, in addition function of policy and regulatory frameworks in fostering sustainable ISW management. Overall, this review study emphasizes the value of an integrated strategy for ISW management that considers the economic, social, and environmental facets of sustainability.

Keywords: *Incineration, biofuels, sustainability.*

1. Introduction

1.1 Background

A major environmental, economic, and health burden, solid waste is an increasing global concern. Any material that is thrown away and isn't meant for future use is referred to as "solid waste," and this includes trash from homes, businesses, industries, and construction and demolition projects. There has been an increase in the volume and complexity of solid waste generated globally as a result of the rapid growth of urban populations and shifting patterns of consumption and production. Significant environmental issues have resulted from this, including resource depletion and greenhouse gas emissions as well as soil, air, and water contamination. Solid waste management has emerged as a crucial concern for sustainable development [1].

The conventional method of waste management, which centered on landfill disposal, has shown to be unsustainable and harmful to the environment. The reduction of trash at its source, material recycling and recovery, and safe and environmentally friendly disposal techniques are now prioritized in waste management programmers. The management of solid waste has a big impact on the economy. Negative effects on tourism, higher expenses for local governments, and missed chances for economic growth through recycling and material recovery are all consequences of poor waste management techniques. Sustainable waste management techniques have become increasingly necessary in recent years, and creative solutions have been developed and put into practice as a result. These include trash

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separation, recycling, and energy conversion technologies as well as legislative efforts to encourage waste minimization and environmentally friendly consumption.[2].

1.2 The Case Study Organizations' History

Maharshi Dayanand University (MDU) discussed in this paper is located in Rohtak, a city in the northern Indian state of Haryana. The university is situated on Delhi-Rohtak National Highway No. 10 and is approximately 75 kilometers away from the national capital, New Delhi. The university campus covers an area of over 750 acres [3].

2. Materials and methods

2.1. Materials

A container with a 2.5 kilograms empty weight and a volume of 50 l was used to collect and weigh the garbage, along with a weighing balance with a 120 kg weight capacity. Other amenities included gloves, for personal safety, furthermore to shovels and forks to load and separate the trash. The amount of waste generated by households was measured using a plastic container with a 20l capacity and a 0.5 kg empty weight. When the truck was fully filled, its contents were separated into seven categories: Waste associated with trees, including plastics, tissue paper, cardboard and papers, metals, glass, food remnants, and. The truck was then unloaded far from the pickup stations. Once a week, the leaves from the trees as well as other stuff they produce are collected. Each dumpster's net amount of each type was calculated, and the campus's total weight was estimated by adding the weights of all the dumpsters [4]. Additionally, distinct university buildings were surveyed to determine the total amount of MSW and the amounts of each component waste type. These structures stand in for many academic functions like instruction, hands-on learning, dining, social services, and administrative operations.

2.2. Methods

2.2.1Waste measurements were made in student housing halls, offices, canteens, cafeterias, and social clubs. The locations for the measurements were those that were thought to represent significant and frequent sources of garbage. This was in keeping with the requirement to obtain a diverse range of trash sources and types from the organizations [4].

Due to ongoing development on the new campus' expansion initiatives, this study was limited to the MDU campus. The total weight of solid garbage produced on the MDU campus includes the weight of all solid waste produced by each of the university's buildings, including the college buildings, administrative buildings, and service buildings. The MSW samples were gathered at least once a week for the duration of a full academic term from all sources on the MDU campus, excluding the labs. The difference between the truck's weight before and after loading the collected trash served as a proxy for the volume of all the MSW generated on the MDU campus. After the filled vehicle was released far from the collection stations, its contents were divided into seven categories: plastics, tissue papers, cardboard and papers, metals, glass, food residues and tree related waste. The tree leaves and tree and other items generated by the trees are collected once a week. The net amount of each type was determined for each dumpster, and the overall weight was calculated for the campus by the summation of all dumpsters' weights [4].

Additionally, distinct university buildings were surveyed to determine the total amount of MSW and Waste relating to trees, including plastics, tissue paper, cardboard and papers,

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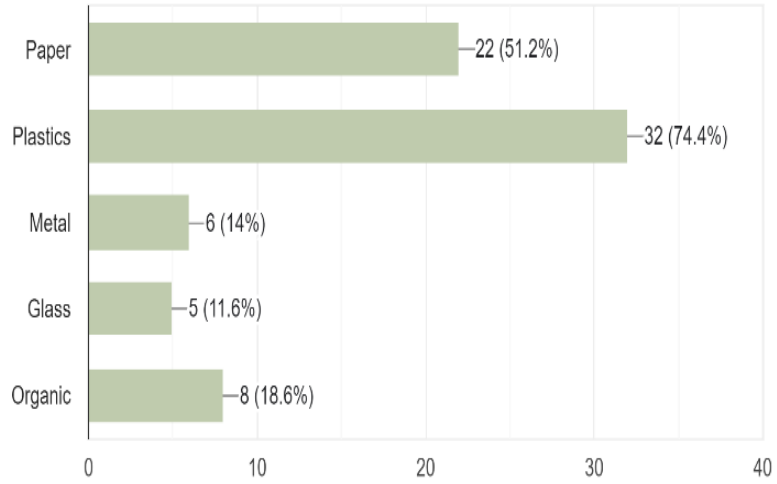
metals, and glass. Once a week, the leaves from the trees as well as other stuff they produce are collected. Each dumpster's net amount of each type was calculated, and the campus's overall weight was estimated by adding the weights of all the dumpsters. These structures stand in for many academic functions like instruction, hands-on learning, dining, social services, and administrative operations, Because there were no hazardous components in the collected type of MSW, it was labelled as "non-hazardous." However, certain types of laboratory trash (such as that is created in laboratories, both chemical and biological), hygiene waste, and medical waste were designated as "hazardous" and were gathered independently by private trash collection and disposal methods and contractors. In accordance with ASTM guidelines, samples measuring 200 to 300 pounds (91 to 136 kg) can be selected, and a single sample weighing 100 kg is a reliable indicator of the characteristics of the entire waste stream. During the course of our investigation, a sample of kg was taken from the total quantity of waste produced each week on each given day. The research was done throughout the school year's working days.[5].



2.2.2. Students' hostels

Hostels were chosen as the of residence for students at MDU Rohtak, making up 82 percent of the total number of beds available. Hostels also accommodated the differences in trash produced by male and female students. Because the total number of residential hostels was low and the distance between them was short, all of them were covered for MDU. However, 50 to 60 percent of the students residing in the blocks were represented in the trash samples gathered from each hostel. As a student living in the Maharshi Dayanand University (MDU) dorms, I was interested in learning how the institution managed its solid waste. Both male and female students were equally covered. My hostel's trash management procedures were the subject of a case study, which I considered to be rather impressive.

In accordance with a contract, food scraps from the hostel kitchen were collected and delivered to a pig farm to be used as pig food. This not only made sure that food waste was disposed of properly, but it also gave farm animals a source of food. Knowing that the hostel administration had taken a proactive move to promote sustainable trash management techniques was encouraging. The municipal corporation tractor also gathered paper and plastic waste that was produced in the dormitories in addition to food waste. The tractor would regularly visit all of the hostels, including ours, to collect the trash. This assured that

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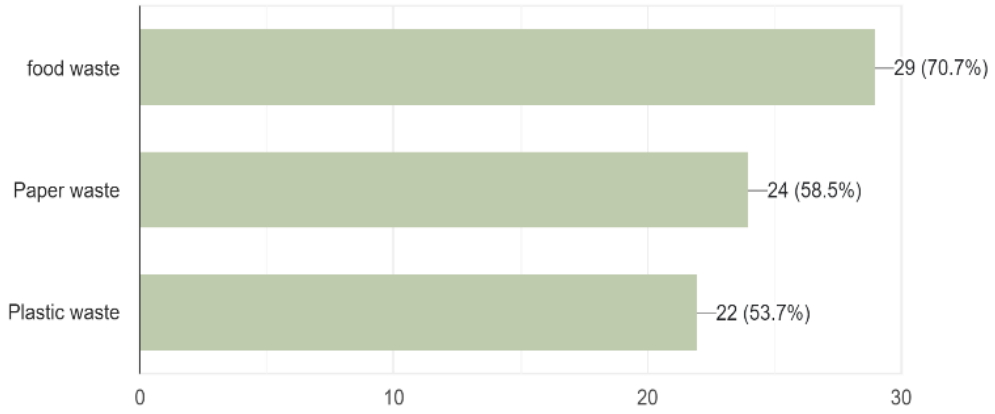
the waste was gathered and disposed of properly, minimizing the impact of solid waste on the environment. It was interesting to observe that all 20 hostels in MDU use the same trash management techniques.



Type of Solid waste in Hostels

The following procedures were used to measure solid waste samples:

1. Utilising a weighing scale to determine the weight (Wb) of an empty bin.

2. Bin must be continuously shaken while it is filled with sample garbage to prevent excessive void areas.

3. Use of a weighing scale to calculate the combined gross weight (WT) of a (bin) container and waste;

4. calculating the volume (VW) of the waste in the trash can;

5. calculating the time (ts) that the garbage was stored and the individuals (p) that were involved in the waste generating.

Throughout the whole study period, the approach was used to measure waste samples at various waste sources and on various sampling days.

The waste generation rates (W_G) were computed using the relation:

$$W_c = \frac{(W_T - W_b)\ (kg)}{p(pe) \times t_s(d)}\ (kg\ pe^{-1}\ d^{-1})$$

The population equivalent is called pe. Thus, the bulk density, b, was calculated:

$$\rho = \frac{(W_T - W_b)}{V_W}\ (kg\ m^{-3})\ [4]$$

- For food waste of individual hostel

Volume of food waste per day = 0.089 m3

Empty weight of 200 l water drum = 9 kg

Weight of container with food waste = 48.06 kg

Population contributed = 200 pe

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Time during the food is stored = 3 days

Type	Hostel waste rate	No. of hostel	Volume(m^3)	Weight(kg)
Food Waste	0.089(m^3/day)	20	1.78	220
Dustbin Waste	4(kg/day)	20	-	80
Total				300kg

After all values put in the Waste generation rate formula as given above

We get,

Waste generation per day =300kg/day

2.3 Studying solid waste management in higher education institutions is important.

Universities cannot afford to overlook the environmental problems brought on by their operations, one of which is solid waste, regardless of the legal environmental pressure. The community will learn how to address the issues brought on by insufficient solid waste management through integrated waste management programs inside the educational institutions. These programs use extremely straightforward yet consistent and coordinated procedures. The use of waste management programs by greater segments of the population can be facilitated by examples like this one.

More focus must be placed on solid waste characterization studies and solid waste management (SWM) on campuses because (1) there hasn't been much written about this subject and higher education institutions are a specific case of research, Due to their level of autonomy, campuses can support novel SWM strategies that may eventually spread to other communities, SWM can both educate and sanitize campuses because it involves students at all levels. The value of waste characterization studies is supported by the clear advantages they provide for developing and putting into practice waste management plans.

3. Adverse Effects of Solid Waste.

3.1. Municipal solid waste's effects on the environment and health

India has experienced significant population growth, urbanization, and changes in consumer patterns, which have resulted in the production of enormous amounts of solid garbage. According to report, 84,475 wards across India produce 1,47,613 metric tons of solid trash every day. Under excessive strain is the current collecting, transportation, and disposal process used for municipal solid waste management. Therefore, inappropriate disposal of solid waste presents a serious threat to public health.

The Planning Commission estimates that 52 percent of all garbage is made up of organic materials that are produced at homes. This organic waste can go through a fermentation process, which helps microbial pathogens survive and flourish. As a result, it could pose a major threat and result in health risks. Direct contact with such solid waste can result in a variety of chronic illnesses and infections.

The negative repercussions of solid waste are numerous. For instance, unmanaged trash along the roadside, which is common throughout much of India, can act as a breeding habitat for mosquitoes, cockroaches, and rats. It is generally known that these rodents spread diseases like dengue and malaria as well as food poisoning.

Therefore, inappropriate solid waste disposal and littering can have a significant negative impact on public health due to disease-carrying bugs.[7]

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3.2. Problems with Uncoordinated Solid Waste Disposal

UNDP lamented in 2007 that improper management of solid wastes can lead to numerous risks and hazards for human wellbeing, albeit the relative importance of each risk and hazard depends on local factors. Uncollected trash clogs drains, causes flooding, deteriorates the environment, and is unsightly.[8]

3.3. Management of solid waste in HEIs

Campuses are particularly complex due to their size, population, and range of intricate activities that take place there, universities are comparable to tiny towns. Due to the expansion in people, development of new areas, and other infrastructures, HEI's waste production has also increased. If this garbage is not properly handled and disposed of, it may constitute a threat to the environment [8]

4. Hierarchy of Sustainable Solid Waste Management

A popular resource for sustainable solid waste management and disposal is the Earth Engineering Center at Columbia University designed the Hierarchy of Sustainable Waste Management. In light of this hierarchy, this report is being delivered. The initial waste management hierarchy, which is completed by sanitary landfills, has been modified for the purposes of this study to include "Unsanitary Landfilling and Open Burning" (SLFs). Unhygienic landfilling and open burning will stand in for the careless disposal and incineration of MSW, as well as the overall state of SWM in India and other developing nations.

Each country may follow the waste management policy (hierarchy) as under;

(i) Waste prevention or minimization

(ii) Waste utilization

(iii) Waste recycling

(iv) Waste processing

(v) Waste-to-Energy

(vi) Landfilling [9]

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Discussion

According to the current solid waste situation, the average quantity of solid trash produced per person worldwide is substantially lower, but due to the extremely dense population, there remains a serious problem. While most industrialized nations primarily produce packing garbage like paper, cardboard, and plastic with low moisture contents, India's solid waste is primarily composed of organic materials with high moisture levels. The quantity, quality, and typology of trash generated in the various There are different states and regions in India. As a general rule, most states and cities have high moisture content and low calorific values. The amount of money and resources that are available, the tactics that are used, and the planning methods used vary significantly between them. Other factors that vary include the amount of land that is available and the size of the necessary facilities for recycling and processing.

The source-level separation of trash is the major obstacle facing Indian municipalities. It is important to address the social taboo surrounding garbage and its related group, which is primarily comprised of marginalized members of society. It is necessary for the development of a waste management system that there be widespread public awareness. Already, a sizeable sum of money has been committed, but neither a thorough evaluation nor a development strategy have been made. The impacts of SWM on environmental quality and public health must be explored and evaluated considering their specific settings. Because garbage cannot be collected every day by collection trucks, solid waste storage is another problem. The secondary bins are commonly observed to be besieged by ragpickers, to be overflowing with leachate, and to be in confrontation with other animals like street dogs, cows, rodents, etc. The solid waste transportation system is still being developed as a result of inadequate infrastructure. Decentralized waste treatment is rarely carried out in densely populated urban areas due to the lack of available land. The treatment and recycling of solid waste is becoming more difficult due to unplanned financial constraints and inadequate infrastructure because the majority of the established waste to energy and recycling factories have ceased operations or are out of high calorific value solid waste. It is necessary to link the formalized system with the disorganized informal trash sector. Additionally, MSW is typically handled by untrained personnel who lack safety equipment, which needs to be quickly lifted.

The shifting waste typology poses a problem in developing an efficient possible solution for Indian MSW, but it also represents the opportunity for recycling and treatment. India, a growing nation, should put more of an emphasis on a decentralized system of waste management because a substantial amount of its solid waste is organic (wet), demonstrating the enormous potential in the production of compost and biogas utilizing several well-known technologies. The remaining inorganic (dry) fraction might be converted into refuse-derived fuel (RDF), and centralized and decentralized incineration processes could be built. The initial capital expenditure for technologies like pyrolysis and gasification of solid waste is relatively significant. They also need specialized scientific monitoring infrastructure and land. The Government of India has recently revised/developed the guidelines individually for managing building and demolition trash, e-waste, and other hazardous garbage. Some regions may find it helpful to adopt a user fee, penalty, and reward system to encourage an efficient SWM system. Additionally, incorporating cutting-edge methods could help. Thus, the involvement of private players, NGOs, self-help organizations, as well as the integration of all relevant departments, could result in the success of MSWM, increased demand for energy and materials, and a profit-generating asset for India in the future.[10]

Conclusion

This review article on institutional solid waste management in MDU dormitories provides insight into the institution's efficient waste management procedures. Sustainable activities that guarantee proper trash disposal and reduce the environmental impact of solid waste include the contract-based disposal of food waste to a pig farm and routine collecting of paper and plastic debris by the municipal corporation tractor. The amount of garbage generated and the need of effective waste management procedures are both illustrated by the daily collection of 300 kg of food waste from the dormitory alone. The 20 dorms in MDU have identical waste management procedures, which is promising and sets a standard for other universities to follow. Such activities, in my opinion, enhance not just the environment but also the general health and wellbeing of the neighborhood. My review study emphasizes the significance of encouraging trash diversion strategies, minimizing waste creation, and taking proactive measures to promote sustainable waste management practices in educational institutions.

For educational institutions to accomplish outstanding solid waste management practices, especially for paper and food wastes, it is encouraged to adopt environmentally friendly procedures. A few examples include replacing paper-based exams with online and e-learning techniques, converting from paper-based files and documents to electronic filing and documentation systems, and using a central printing system in libraries and schools instead of individual printers in each office. By using these methods, the university will be able to lessen the amount of waste paper produced on its campus.

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