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Waste Material Recovery Process in Indore – A Field Study

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Abstract: ***Waste generation in today's life is increasing day by day in various forms, may it be biodegradable or non-biodegradable. Biodegradable waste like paper, wood, cardboard, and others like metals is not creating trouble as they can easily be recycled or decomposed without harming the environment. On the other hand, plastic and other non-biodegradable waste is becoming a matter of concern for so many reasons to be listed. To overcome such issues, many initiatives have been taken by various groups along with many government programs. This field study deals with one of the material recovery facilities at Indore. This facility was visited and checked for its working procedure. The facility was working on dry plastic waste of different forms, which was being collected from residential, public, and commercial areas in this location. With the help of collecting vehicles and manpower, the waste was collected and segregated in different forms to be sent for further processing to form Gatta pipes, and for other purposes like recycling, waste to recovery plants, and the landfills.***

Keywords: ***Biodegradable, Non-biodegradable, Dry plastic, Gatta pipes, Recovery Plants***

I. INTRODUCTION

Waste generation in today's time is increasing rapidly with the rapid growth in technology and ease of living [7]. This technology and comfort are resulting in generating more and more waste of various types like paper, clothes, glass, plastic, and many on the list [5]. Plastic waste in today's world is the most highlighted and alarming type of waste causing various minor and major issues to not only humans but also to plants and animals including land and water species [1]. The various types of plastic have different properties as per their formation procedure which thereby decides their way of use and the level of harmful effects caused by them [4]. The different types of plastic waste considered are:

A. Polyethylene terephthalate (PET)

Because of its property to restrict oxygen from getting in, it is used mostly for drinking and food packaging materials to keep them fresh for long. They are mostly used as they can be recycled easily [3].

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B. High-Density Polyethylene (HDPE)

This type of plastic is thicker, stronger, and more durable than PET. It is used in shampoo bottles, milk containers, bags used for grocery purposes, pipes used for agricultural purposes, and many other areas [9]. It can resist a temperature up to 120 degrees Celsius without getting deformed. It can also be recycled easily.

C. Polyvinyl Chloride (PVC)

It can be found in rigid as well as flexible forms which can be used as a construction material and wires respectively. This material is being used effectively in construction due to its lightweight, durability, and ease of working [8]. Despite being so useful, it is not recyclable which makes it unfit to be used as far as possible.

D. Low-Density Polyethylene (LDPE)

It is more flexible and thin in design as compared to HDPE. Due to its simple structure, it is easy to manufacture and use. It is mostly used as one-time plastic carry bags for daily purposes [2]. Being very much found as a waste material and cheaper to produce, it is not much taken into account for recycling.

E. Polypropylene (PP)

It is hard and durable which makes its demand going high day by day [6]. It can resist a high temperature because of which it is used in car parts and thermal products. Due to its high fatigue resistance, it is used for parts to be bent up to 180 degrees.

F. Polystyrene (PS)

It is a cheap and easily manufactured type of plastic. It can be used to make disposables, insulating and packing materials, and many more. It is non-biodegradable which makes it the worst plastic among all the other types [5].

G. Polycarbonates (PC)

It is a tough and strong type of plastic that is most widely used in making sunglasses, goggles, and CDs. It is also a plastic which has a high potential to harm the environment and needs careful management [7].

II. BACKGROUND STUDY

Waste material recovery technologies in India are gaining popularity as concerns about environmental degradation and resource depletion grow [13]. Historically, waste management procedures in the country have been inefficient, resulting in severe environmental damage and resource waste [11].

However, in recent decades, there has been a significant shift toward sustainable trash recovery projects, thanks to government policies, technical developments, and increased public awareness [12].

A. Enhancement Process

Over time, India's waste material recovery procedures have improved significantly. Several forces have pushed these developments forward. First, government initiatives such as the Swachh Bharat Abhiyan (Clean India Mission) have raised awareness and encouraged investment in waste management infrastructure [14].

Furthermore, advances in recycling technologies have made it easier to recover valuable materials from various waste streams, so supporting a circular economy [10]. Furthermore, the introduction of new business models and public-private partnerships has led to increased efficiency and scale in waste recovery operations [11]. Collaboration among stakeholders, including governments, industries, non-governmental organizations (NGOs), and communities, has hastened the national adoption of sustainable waste management methods [12].

This upward trend demonstrates India's dedication to tackling environmental issues while also capitalizing on the economic possibilities of waste material recovery. Continued investments in technology, policy support, and community participation are critical for sustaining and expanding these activities in the future.

III. SOURCE AND RESOURCES USED

The waste in its dry form which was being worked upon here was collected from the residential, public, and other commercial areas where it was found that the waste is generated in a large amount and which has to be taken care of seriously. The facility site which was studied had the capacity of 12 tons per day to be collected and processed. Five vehicles were deployed to collect the garbage from these areas having a vehicle capacity of 150 kg. These vehicles used to make two trips per day to collect the daily waste of about 1.5 metric tons which was finally coming to the processing site. Along with the five vehicles, there were a total of six female waste pickers working efficiently in the process of collecting waste.

IV. MATERIAL COLLECTION, SEGREGATION

Vehicles and waste pickers are collecting a mixed kind of dry waste generated in the areas mentioned above including HDPE, rubber soles, beer cans, beer bottles, cotton clothes, MLP, LDPE, cardboard, milk pouches, paper, PET bottles, many more in the list. This mixed waste is then segregated manually by workers into ten types of dry waste. Some types of waste materials like HM and MLP, which are segregated, are not in cleaned form, so they are sent to a dusting machine to be cleaned for further processing.

Out of all the dry waste collected, only 60 percent of the waste is recovered whereas, the other 40 percent including glass, shoe soles, paper, clothes, and food packaging materials are sent to other processing sites or landfills as per the properties and requirements.

Figure 1. Waste Collected from Various Places

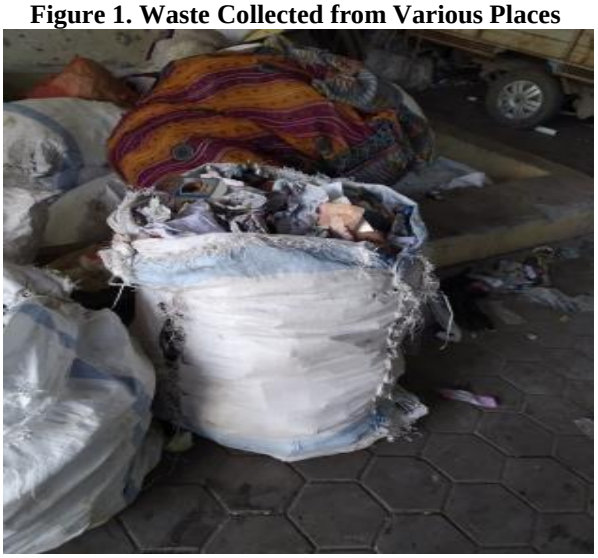

Figure 2. Waste Stored in Segregated Form

V. POST PROCESSING

All the types of plastic, paper, glass, cardboard, metals, and other types of materials are segregated and stored separately in the store. This segregated material is then sent to various other industries using them as a raw material to prepare some other material or as a recycling material.

Material like glass is collected and directly sold to other vendors working on glass. Waste cloth is sent to refuse-derived fuel (RDF) plants like cement factories or waste to energy plants without any processing, where they are converted to fuel to be used for commercial purposes. The paper waste collected has a very poor quality which makes it unsuitable for the recycling process. So, it is sent to landfill sites directly.

The only waste that is harmful as well as non-recyclable is MLP, i.e., Multi-Layered Packaging material, which was observed coming in more quantity. The vendors who take the raw material from this site, pay for the material as per the prevailing rates and take these materials to their processing units.

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All the segregated plastic waste materials like PET, LD, HM, and MLP are sent for baling after which they are weighed. These materials are then used for making gatta and making agricultural pipes.

The vendors taking the raw material from this site had the condition of minimum available material for the transportation, which was 8-10 MT. Below this amount, the vendors refuse to buy the material as this will cost them much as compared to more material. As the current stock was lower than 8 MT, the site is not in a condition to sell any waste as a result has to store the collected waste itself.

VI. CONCLUSION

From the study, it was found that the capacity of the facility was 12t/day having a decentralized type of working mechanism. On the site, it was found that all the waste collected could not be used for further processing. The efficiency of the plant in the recovery process was only 60% which means that more accurate methods of segregation and recovery have to be used.

Other waste was sent to related vendors, RDFs, and landfills as per the requirement. Out of all the waste collected, MLP or Multi Layered Packaging material was dominating which needed to be processed efficiently as it is non-biodegradable and non-recyclable. The overall process of collecting, segregating, and post-processing methods needs to be effective so that waste utilization can be improved and landfill waste can be reduced to as much as possible so as to make use of landfill sites efficiently.

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AUTHORS PROFILE

Deepti Dohare, an M. Tech graduate from IIT Hyderabad in Civil Engineering, has carved a niche in both academia and the entrepreneurial landscape. As an Assistant Professor for the past five years, Deepti combines her passion for teaching with extensive practical expertise. Concurrently, she has been actively engaged in innovation and entrepreneurship, where her focus is on fostering new business ideas and technological advancements. Deepti's work extends significantly into waste management, leveraging her engineering background to tackle environmental challenges through innovative solutions. Her skill set is comprehensive, including Entrepreneurship Development, Startup Mentorship, and Strategic Planning and Execution. She excels in Stakeholder Engagement and is proficient in Program and Event Management. She is a strong networker and community builder. Her understanding of Intellectual Property adds a valuable dimension to her role, protecting innovations while fostering a culture of knowledge-sharing.

Shruti Dohare is a Mechanical Engineer from WIT, Dehradun, who began her professional journey as a Graduate Engineer Trainee at Spark Minda. Demonstrating a robust blend of technical proficiency and entrepreneurial spirit, Shruti is actively exploring ventures in the field of waste management, driven by her desire to apply her engineering background to sustainable environmental solutions. Within just a year, Shruti has made significant strides in her career. She is proficient in Program and Event Management and her skills in Networking and Community Building have allowed her to cultivate a broad professional network, enhancing her influence and effectiveness in collaborative projects. Moreover, Shruti's capabilities in Communication and Leadership are evident in her ability to lead teams and manage projects efficiently. Her market research and analysis skills provide a strong foundation for identifying viable opportunities and trends in the waste management sector, ensuring that her initiatives are both innovative and commercially viable

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