WASTE TO WEALTH: RECYCLE WASTE MANAGEMENT IN INDIA

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ABSTRACT

Waste management entails preventing trash, reusing waste, recycling, sorting recyclables from non-recyclables, and using waste as a fuel source. It also entails creating waste disposal systems and procedures, eradicating illegal dumps, and promoting waste management. The procedures involved in collecting, transferring, sorting, recycling, disposing, tracking, and monitoring trash are referred to as "waste management." The hardest part of recycling is gathering waste for recycling, or sorting waste, because it requires physical labour at numerous points, which raises the price of recycling. One of India's most urgent development challenges is solid waste management (SWM). Numerous studies have demonstrated that due to microbial decomposition, environmental conditions, refuse characteristics, and land-filling practices, inappropriate waste disposal results in the production of toxic gases and leachates. The majority of ULBs, however, struggle with a lack of adequate infrastructure as well as a number of institutional and strategic issues, such as insufficient institutional competency, constrained finance, and a lack of political will. Almost all Indian ULBs endure financial volatility, even though many of them do receive government funding. Every landfill site in India is already occupied, and the appropriate ULBs lack the funds to purchase more land. Since local authorities are unwilling to reserve property inside their borders for waste from neighbouring regions, finding additional dump sites is also difficult. To address these concerns, the Ministries of Housing and Urban Affairs (MoHUA) and Environment, Forest and Climate Change (MoEFCC) have created joint policies and programmes. The bulk of projects have, however, fallen short of their objectives due to stakeholder confusion, a lack of knowledge, and inadequate regulator enforcement. Each person generates 450 grams of waste each day, and this amount has been increasing at a rate of 1.3 percent every year. In 84,456 wards as of January 2020, waste production ranged from 32 MT to 22,080 MT daily. Sikkim generates the least (89 MT per day), while Maharashtra produces 22,080 MT per day (from 7,322 wards) (from 53 wards). Delhi produces the most garbage of any Union Territory, at 10,500 MT each day (UTs). In India, Daman & Diu have the lowest per-capita waste production. Solid waste processing, treatment, and disposal-composting, bio-methanation, recycling, refuse-derived fuel, incineration, pyrolysis, waste-to-wealth, and waste-to-energy are a few of the processing methods now used in India. This paper discusses recycling waste management in India.

Key Words — **Solid Waste, Waste Management, Recycling**

I. INTRODUCTION

Recycling is the process of turning waste into new substances and products. A material's capacity to regain the characteristics it had in its initial state determines how recyclable it is. It is an alternative to "conventional" waste disposal that can conserve resources and aid in reducing greenhouse gas emissions. Additionally, it can reduce the consumption of fresh raw materials and the waste of potentially useful materials, which will cut down on energy use, air pollution from landfilling, and water pollution from incineration.

Waste management entails preventing trash, reusing waste, recycling, sorting recyclables from non-recyclables, and using waste as a fuel source. It also entails creating waste disposal systems and procedures, eradicating illegal dumps, and promoting waste management. The procedures involved in collecting, transferring, sorting, recycling, disposing, tracking, and monitoring trash are referred to as "waste management." The hardest part of recycling is gathering waste for recycling, or sorting waste, because it requires physical labour at numerous points, which raises the price of recycling.

Hazardous waste can be produced as a result of combat, chemical plant explosions, NHB occurrences (transport, storage, accidents, and natural disasters), and other events. Due to its physical (solid waste, dust, noise, vibrations), chemical (aerosols, gases, vapours, fumes, dust, waste), radiological (ionising, UV, oils, infrared, radar, laser, ultrasound, x-ray), and biological components, workplace pollution is dangerous and lethal (viruses, bacteria, mould, fungi, parasites, insects, and rodents). Waste is discharged into streams and basins on the surface and below. After being stored in designated landfills, solid waste is buried and discharged into abandoned mines. Fertilisers and pesticides are used in agriculture (about 70,000 different harmful and hazardous substances, and the list is supplemented annually with new 900 –1000 terms). For freshly generated substances that are not found in the working environment or in living organisms, decomposition is conceivable (PVC materials). The number of materials floating in the seas and oceans is estimated to be close to 40 million, including plastic bottles, bags, lost and abandoned fishing nets, nylon, and other objects.

II. SOLID WASTE MANAGEMENT IN INDIA

One of India's most urgent development challenges is solid waste management (SWM). Numerous studies have demonstrated that due to microbial decomposition, environmental conditions refuse characteristics, and land-filling practices, inappropriate waste disposal results in the production of toxic gases and leachates. The majority of ULBs, however, struggle with a lack of adequate infrastructure as well as a number of institutional and strategic issues, such as insufficient institutional competency, constrained finance, and a lack of political will. Almost all Indian ULBs endure financial volatility, even though many of them do receive government funding. Every landfill site in India is already occupied, and the appropriate ULBs lack the funds to purchase more land. Since local authorities are unwilling to reserve property inside their borders for waste from neighbouring regions, finding additional dump sites is also difficult. To address these concerns, the Ministries of Housing and Urban Affairs (MoHUA) and Environment, Forest and Climate Change (MoEFCC) have created joint policies and programmes. The bulk of projects have, however, fallen short of their objectives due to stakeholder confusion, a lack of knowledge, and inadequate regulator enforcement.

[a] Generation and composition of solid waste

Globally, cities generated 2.01 billion tonnes of MSW in 2016 or 0.74 kilograms per person each day. Due to increasing urbanisation and population expansion, the yearly waste creation is predicted to increase by 70% from 2016 levels to 3.40 billion tonnes in 2050. Numerous factors, such as population growth, increased wealth, and changing consumption patterns, contribute to this variation in solid waste output. Increased population directly affects the amount of waste produced, especially in urban areas. In India, waste generation has considerably increased during the last few years. According to the Swachhata Sandesh Newsletter, 84,475

wards generated 147,613 metric tonnes (MT) of solid waste every single day. Urban India is expected to produce 2,76,342 tonnes of waste per day (TPD) by 2021, 4,50,132 TPD by 2031, and 11,95,000 TPD by 2050, according to the Task Force on Waste to Energy report.

Each person generates 450 grams of waste each day, and this amount has been increasing at a rate of 1.3 percent every year. In 84,456 wards as of January 2020, waste production ranged from 32 MT to 22,080 MT daily. Sikkim generates the least (89 MT per day), while Maharashtra produces 22,080 MT per day (from 7,322 wards) (from 53 wards). Delhi produces the most waste of any Union Territory, at 10,500 MT each day (UTs). In India, Daman & Diu have the lowest per-capita waste production.

Three categories can be used to classify solid waste: [i] waste that can be recycled; [ii] inert, non-biodegradable trash; and [iii] organic waste that can decompose (food and kitchen waste, green waste, vegetables, flowers, leaves, fruits, and paper, etc.). In the Planning Commission Task Force research, 52 percent of the waste is biodegradable, followed by inert and non-biodegradable components at 32 percent. It is believed that 17% of waste is recyclable, and this number has been rising over time. Data from a few places show that the annual percentage of biodegradable waste is between 55 and 60 percent.

According to the NGT bench, each manufacturer or brand owner must submit an application for registration or renewal of registration and such registration must be completed in line with the CPCB's checklist. Local governments are urged to employ plastic waste for waste-to-energy projects, road construction, etc. The National Highway Authority of India (NHAI) expressly encourages the use of plastic waste in the construction of national highways in areas with a population of at least 5,000 in order to assure the utilisation of the non-recyclable plastic waste collected.

On June 5, 2017, World Environment Day, the Indian government unveiled a national strategy to eliminate all single-use plastic by the year 2022. Along with straws, Styrofoam containers, coffee stirrers, and plastic cutlery are also included.43% of all plastic consumed in India is contained in single-use, disposable packaging used by online retailers. Andhra Pradesh, Arunachal Pradesh, Assam, Chandigarh, Chhattisgarh, Delhi, Goa, Gujarat, Himachal Pradesh, Jammu & Kashmir, Karnataka, Maharashtra, Odisha, Sikkim, Tamil Nadu, Uttar Pradesh, Uttarakhand, and West Bengal are among the 18 states and UTs that have banned the manufacture, distribution, sale, or use of plastic carry bags.

Plastic waste has become a big concern that is contributing considerably to the ecosystem's decline. India generates 9.4 million tonnes of plastic waste yearly, or 26,000 tonnes of plastic waste per day (TPD). The National Green Tribune (NGT) has instructed the Central Pollution Control Board (CPCB) to establish rigorous restrictions on the entry of plastic waste into India in order to address this issue because it is detrimental to the environment. Massive initiatives to collect plastic waste have also been launched, and as of October 21, 2019, 4.02 MT of plastic waste had been gathered with the help of more than 6.41 crore people. This non-recyclable material is used extensively in furnace oil and road construction.

[b] Waste Transport and Collection

The sewerage and drainage systems are regularly clogged by a sizeable amount of the collected waste that is frequently dumped recklessly. These serve as habitats for rats and insects that reproduce and spread harmful diseases. Ahmadabad collects the most waste (54 percent), whereas Delhi collects the least (39 percent), according to a report released by ICRIER in January 2020. (95 percent). The nation's informal economy plays a significant role in waste control. The law does not provide legal protection or formal recognition for workers in the unofficial sector. They collect more than 10,000 tonnes of recyclable waste each day without the proper attire, footwear, or even safety equipment like gloves and masks. The existing SWM regulations do not reward waste pickers in any way or recognise the economic value of recycling informal

trash. As a result, SWM has a much smaller negative effect on ULBs. For moist waste, decentralised composting or biomethanation techniques are used. The segregation rates in the remaining 40 of Tamil Nadu's 50 smaller municipalities range from 80 to 90 percent. But in the majority of jurisdictions, combining segregated and non-segregated trash remains a severe problem.

This campaign claimed that "source segregation" would spread like wildfire over all cities and towns. The MoHUA's 2020 "Swachhata Sandesh Newsletter" states that as of January 2020, 63,204 wards (or 74.82 percent) had achieved 100% waste segregation at the household level. In Chhattisgarh and Kerala, all homes in every ward have effectively followed the practise of waste segregation. Among the UTs, Daman & Diu and Dadra & Nagar Haveli have completed source segregation.

In accordance with the SWM Act (2006), segregated trash must be picked up door to door, and waste generators must pay a user fee to the waste collectors. However, the laws make no mention of how the cost is determined—whether it is assessed in accordance with the quantity or type of waste generated. In India, 100% door-to-door garbage collection had been achieved in 81,135 wards (96.05%) of the country's 84,475 wards as of January 2020. These wards included each and every one in the states of Andhra Pradesh, Arunachal Pradesh, Chhattisgarh, Goa, Gujarat, Karnataka, Madhya Pradesh, Mizoram, Rajasthan, Sikkim, and Uttarakhand. Additionally, door-to-door collection is now available in all UTs. Both this area and source segregation at the municipal level has seen substantial advancement in Mysore. In Mumbai and Chennai, door-to-door collection has surpassed 80%. However, door-to-door garbage collection is still ongoing in Tirunelveli, Vengurla, and Uttarpara-Kotrung.

The amount of waste, the distance, the breadth and condition of the road, and process technology are typical factors that affect the choice of vehicle. In order to cut down on travel time, lower human error, and enhance the monitoring system, many ULBs have installed a Global Positioning System (GPS), a Geographic Information System (GIS), and a Global System for Mobile Communication in their vehicles to collect waste from secondary sources for waste disposal.

Solid waste processing, treatment, and disposal composting, bio-methanation, recycling, refuse-derived fuel, incineration, pyrolysis, waste-to-wealth, and waste-to-energy are a few of the processing methods now used in India. The type and volume of waste that is available, as well as its calorific value, the availability of funds and resources, capital investments, cost recovery, the internal capacity of ULBs, the availability of land, and the environmental sensitivity of the locations, all play a role in determining which technology is used. Chhattisgarh processes 90% more waste than any other state, whereas Meghalaya processes the least amount of waste (four percent). Chandigarh processes 95% of the trash inside the UTs, compared to 100% in Dadra & Nagar Haveli. Only 55% of Delhi's applications are processed, which is less than the 84,475-ward average of 60%.

Table

Total Waste Processing under SBM, as of January 2020

States / UTs	Total Wards	Total Waste Processing (%)
Andhra Pradesh	3,409	63
Andaman and Nicobar	24	95
Arunachal Pradesh	75	0
Assam	943	53
Bihar	3,377	51
Chandigarh	26	95
Chhattisgarh	3,217	90
Daman and Diu	28	75
Dadra and Nagar Haveli	15	100
Delhi	294	55
Goa	217	70
Gujarat	1,427	87
Haryana	1,496	48
Himachal Pradesh	497	78
Jammu and Kashmir	1,081	16
Jharkhand	932	60
Karnataka	6,464	54
Kerala	3,536	71
Madhya Pradesh	7,115	87
Maharashtra	7,322	58
Manipur	306	58
Meghalaya	114	4
Mizoram	264	35
Nagaland	234	60
Odhisha	2,024	48
Pondicherry	122	13
Punjab	3,123	61
Rajasthan	5,389	72
Sikkim	53	70
Tamil Nadu	12,814	68
Telangana	2,112	78
Tripura	310	53
Uttar Pradesh	12,007	58
Uttarakhand	1,170	46
West Bengal	2,938	9
Total / Average	84,475	60

Source: MoHUA, 2020

Large amounts of waste are frequently processed using either biomethanation or composting methods in order to provide biogas, energy, and compost. Vermicomposting and aerobic composting are the two most commonly used methods for handling biodegradable waste. Effective waste separation is necessary for composting, but it is challenging in India due to the prevalence of mixed waste being dumped in public areas. Segregation can lessen the burden of trash transportation while reducing leachate and greenhouse gas (GHG) emissions. Distinct portions of the waste can be utilised in various production processes, providing economic use value, if it is separated at the time of generation.

When waste is sorted at the source, a higher percentage of recyclable trash can be collected and put to use. Plastic bags, mylar or laminated metalized plastics, shredded paper, and textiles are just a few of the items that make up dry trash and cannot be recycled. Unlike glass, plastic, and metals, paper can be recycled and decomposed. Currently, only 33% of India's seven million tonnes of packaging paper are being collected and recycled. Aside from being recycled to create newsprint and writing or printing papers, old books, magazines, newspapers, etc. are also used to make paper bags. Both the reuse and recycling of plastics require extremely little energy during production. You may recycle shopping bags to create eco-friendly items. The Coorg municipality in Karnataka started recycling plastic carry bags using polylooms, a sort of handloom for weaving plastic.

Recycling, as defined by the SWM Rules (2006), is the process of turning separated solid waste into a brand-new good or a source for making one. About 18-20% of the total garbage is made up of recyclable and reusable materials, and it takes a lot of time and effort to separate them from mixed waste. Rag pickers, waste-pickers, itinerant waste buyers (kabariwala), dealers, and recycling units frequently collect recyclable materials, which lessens the burden on landfill sites, lessens pollution and other adverse environmental effects, reduces the volume of waste, and lowers the cost of collection, transportation, and disposal. Additionally, recycling has significant economic benefits, such as reducing the need to import raw materials and fertiliser and creating job opportunities for recyclers.

Only when the extra cost of gathering the materials, sorting them for recycling, and marketing the materials is recovered from the recycled product does recycling make economic sense. According to a study by ICRIER, few towns have biomethanation plants that produce manure, but many cities have composting facilities that are regrettably underutilised because there isn't much of a market for compost.

[c] Solid waste disposal

In India, open burning and waste dumping continue to be the main methods of waste disposal. According to the Planning Commission, 80% of the waste that is collected in India is unclearly dumped in dump yards, endangering both human health and the environment. In India, seeing waste thrown on the side of the road, occasionally pouring over drains, or floating on rivers' water is nothing out of the ordinary. Additionally, due to debris blocking the drains during the rainy season, residential areas, roadways, and even train tracks flood and become waterlogged, disrupting daily life. Furthermore, there is a lot of garbage in the streets and other public spaces.

III. CONCLUSION

The Ministry of Environment, Forest and Climate Change, Government of India, has modified the Solid Waste Management Rules, 2016. As per the rules, solid waste means solid or semi-solid domestic waste, sanitary waste, commercial waste, institutional waste, catering and market waste, and other non-residential wastes, street sweepings, silt removed or collected from surface drains, horticulture waste, agriculture, and dairy waste, treated bio-medical waste, excluding industrial waste, bio-medical waste and e-waste, battery waste, radio-active waste generated in the area under the local authorities. As per the rules, the local bodies are responsible for the collection, treatment, and disposal of solid waste. The Board is the monitoring authority under the said rules and is responsible for granting authorization to local bodies for the processing and

disposal of solid waste. The Board is advocating the concepts of waste segregation at source, waste reduction, recycle and reuse to avoid any environmental issues during handling.

References

[1] Amar Dhere, Chandrasekhar Pawar, Pratapsingh Pardeshi and Dhanraj Patil, Municipal solid waste disposal in Pune city – An analysis of air and groundwater pollution, Current Science, Vol. 95, No. 6, 25 September 2008

[2] Chaunglin Fang, Danlin Yu, ''Urban Agglomeration: An Evolving Concept of Emerging Phenomenon'' Landscape and Urban Planning Volume-162 Pg No 126-136 Elsevier, 2017

[3] Isher Judge Ahluwalia and Utkarsh Patel, "Solid Waste Management in India: An Assessment of Resource, Recovery and Environmental Impact

[4] Joshi and Ahmed, Status and challenges of municipal solid waste management in India: A review, Cogent Environmental Science (2016), 2: 1139434

[5] Kumar, Smith, Fowler, Velis, Kumar, Arya, Rena, Kumar, Cheeseman, Challenges and opportunities associated with waste management in India, The Royal Society Publication, R. Soc. open sci. 4: 160764, 2017

[6] Rajan, Irudaya, Bernard Sami and Samuel Asir Raj, Tamil Nadu Migration Survey 2015. Economic and Political Weekly, 52(21): 85–94, 2017

[7] Satpal Singh, Solid Waste Management in Urban India: Imperatives for Improvement. ORF Occasional Paper

[8] Satpal Singh, "Decentralized Solid Waste Management in India: A perspective on Technological Options,"

[9] Swachh Bharat Mission Urban

[10] Swachhata Sandesh Newsletters

[11] Ministry of Housing and Urban Affairs, "Swachhata Sandesh Newsletter,"

[12] Ministry of Housing and Urban Affairs, Government of India, Annual Reports