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A STUDY FOR SOLID WASTE MANAGEMENT PRACTICES IN INDIA

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***Abstract*-- In the present work, a study has been made to analyze the solid waste management practices in India. This study provides a review of the production, collection, characteristics, transportation and their disposal and treatment technology to protect the environment. After the study of various adopted technology used for the disposal of solid management, here we conclude with many fruitful suggestions so that new innovation can be done and to motivate or encourage the researchers to work towards further development of the present methods.**

***Keywords*— Solid waste, Solid waste management, Environmental protection**

I.INTRODUCTION

Feeling very proud to say that the second fastest growing economy is India but my eyes falls down when I say that India is most populated country. As per an expectation it is estimated that during the period 2001-2028 the population will hike from 1029 million to 1400 million. The rural population is 852 million and urban population is 325 million approximately. Today most of the peoples are approaching towards cities. Urbanization level has hiked from 26.5% to 38% in last 60 years. It is expected to hike to 45% by the year 2028. In India rapid industrialization and population explosion has led to migration of people from rural areas to urban areas. This population generates thousands of tons of wastes daily. With the development of technology as we are expected to be the industrialization nation by the year 2021, this development will progress in the solid wastes also. The solid waste amount is expected to increase significantly in the near future with industrial development. We can see huge amount of wastage at every nook and corner due to poor collection and inadequate transportation. We can't blame the municipal committees also because they are going through a critical phase, because of non availability of suitable facilities. They are not able to treat and dispose this huge amount of waste generated by the metro cities daily. Generally, solid waste is disposed of in low-lying areas without taking any precautions or operational controls. So, solid waste management is one of the major environmental problems of Indian megacities. It involves activities associated with production, storage, collection, transfer and transport, processing and disposal of this waste. But, in most cities, the solid waste management system comprises only four activities, i.e., waste production, collection, transportation, and disposal. The solid waste management requires proper infrastructure, maintenance and up gradation of all activities. This becomes increasingly expensive and complex due to the continuous and unplanned growth of urban centers. The difficulties in providing the desired level of public service in the urban centers are often attributed to the poor financial status of the managing municipal corporations.

II.PRODUCTION OF SOLID WASTE

There are many categories of solid waste such as food waste, rubbish, commercial waste, institutional waste, street sweeping waste, industrial waste, construction, building destruction waste and sanitation waste. It contains recyclable (paper, plastic, glass, metals, etc.), poisonous substances (paints, pesticides, used batteries, medicines), compostable organic matter (fruit and vegetable peels, food waste) and soiled waste (blood stained cotton, sanitary napkins and disposable syringes) The amount of solid waste produced depends on many factors such as food habits, standard of living, degree of commercial activities and seasons. This data on quantity variation and production are useful in planning for collection and disposal system. As urbanization is increasing with changing life styles, Indian cities now produce eight times more waste than they did in 1947. Presently, about 90 million ton of solid waste are produced annually as byproducts of industrial, mining, municipal, agricultural and other processes. The amount of solid waste per capita is estimated to hike at a rate of 1–1.33% annually. A graph for Indian cities is given in Table 1(Municipal solid waste generation rates in different states in India; Source: Status of MSW generation, collection, treatment and disposal in
Class-I cities (CPCB, 2000) and Fig. 1(Per capita generation rate of Solid waste for Indian cities)

III. COMPOSITION, COLLECTION AND STORAGE OF SOLID WASTE

The composition of solid waste produced from the basis on which solid waste management system has to be plan, design and operate. The composition of solid waste at production sources and collection points was calculated on a wet weight basis. It consists mainly of a large organic fraction (40–60%), ash and fine earth (30–40%), paper (3–6%) and plastic, glass and metals (each less than 1%). Storage of solid waste at the source is lacking mostly in urban areas. The bins are common for both decomposable and non-decomposable waste (no separation of waste is performed), and this waste is disposed at the communal disposal center. Storage bins can be classified in two groups as movable bins and fixed bins. Movable bins are flexible in transportation but they are lacking in durability, while the fixed bins are more durable but their positions cannot be changed once they have been made. The collection of solid waste is the responsibility of municipalities. The main system of collection at most of the places is done with the help of bins placed at various points along the roads, and sometimes this leads to the formation of unauthorized open collection points. A lot of efforts are being organized for house-to-house collection at many popular places such as Delhi, Mumbai, Bangalore, Madras and Hyderabad. It has been observed that many municipalities have employed private contractors for secondary transportation from the bins placed house to house or collection points to the disposal sites. There are few committees to supervise separation and collection from the production source to collection points situated at intermediate places between sources and dumpsites. In addition, few welfare associations on specific monthly payment arrange collection of garbage in some urban areas. A sweeper is manually allotted a specific area (approx 250 m^2). After sweeping the sweepers put the road garbage into a wheelbarrow, and then transfer this to dustbins. At most places, some waste remains uncollected on streets, and what is collected is transported to processing or disposal sites for disposal. The collection efficiency is the quantity of waste collected and transported from streets to disposal sites divided by the total quantity of solid generated during the same period. Many studies on urban environment have told that solid waste collection efficiency is a function of two factors: manpower and transport capacity. Average collection efficiency for solid waste in Indian cities and states is about 70%, as shown in Table 2 (Per capita generation, disposal and collection efficiency of Solid waste for Indian state; Source: Nema, 2004) and Fig. 2. Mostly cities are not able to provide waste collection services to all parts of the city. Peoples throw away the waste near or around their homes at different times, which create a lot of problems for the collection and transportation of waste in those areas.

IV. SOLID WASTE DISPOSALS AND TREATMENT

The innovative method of waste disposal adopted in India includes composting (aerobic composting and Vermicomposting). Energy is also produced from known as waste-to-energy method (WTE). WTE includes incineration, pelletisation and biomethanation. A WTE project for disposal of waste is a relatively new concept in India. Although this has been tried and tested in many countries with efficient results. Here are some methods for the disposal and treatment of waste has been discussed in the subsequent sections.

A. LANDFILLING

In many metro cities, open, uncontrolled and poorly managed dumping is commonly practiced, produces many serious environmental problems. More than 90% of waste in cities and towns are directly disposed off on land in an improper and unsatisfactory manner. A landfill site is a site for the disposal of waste material by burial. It is the oldest form of waste treatment. Some landfills are also used for waste management purposes such as the temporary storage, consolidation and processing of waste material. Gases are also produced in landfills due to the anaerobic digestion by microbes. In a properly managed landfill this gas is collected and reused.

Table 1

S.No.	Name of state	No. of cities	Population	Solid waste (T/Day)	Per capita production (Kg/Day)
1	Andhra Pradesh	32	10845907	3943	0.364
2	Assam	4	878310	196	0.223
3	Bihar	17	5278361	1479	0.280
4	Gujarat	21	8443962	3805	0.451
5	Haryana	12	2254353	623	0.276
6	Himachal Pradesh	1	82054	35	0.427
7	Karnatka	21	8283498	3118	0.376
8	Kerla	146	3107358	1220	0.393
9	M.P.	23	7225833	2286	0.316
10	Maharashta	27	22727186	8589	0.378
11	Manipur	1	198535	40	0.201
12	Meghalaya	1	223366	35	0.157
13	Mizoram	1	155240	46	0.296
14	Orissa	7	1766021	646	0.366
15	Punjab	10	3209903	1001	0.312
16	Rajasthan	14	4979301	1768	0.355
17	TamilNadu	25	10745773	5021	0.467
18	Tripura	1	157358	33	0.210
19	U.P.	41	14480479	5515	0.381
20	West Bengal	23	13943445	4475	0.321

21	Chandigarh	1	504094	200	0.397
22	Delhi	1	8419084	4000	0.475
23	Pondichery	1	203065	60	0.295
	Total	299	128113865	48134	0.376

B. RECYCLING OF ORGANIC WASTE

If organic waste is left undisturbed, it will decompose by natural process producing odors, hosting and feeding a variety of insects, which in turn, form the carriers of disease creating severe health problems. The separation, decomposition and stabilization of the organic waste by biological action forms the basis of recycling through different natural cycles.

B1. AEROBIC COMPOSTING

Bacterial conversion of the organics present in waste in the presence of oxygen under hot and moist conditions is called composting, and the final product produced after bacterial activity is called compost (humus). It has very high agricultural value used as fertilizer. It is non odorous and pathogens free. From the composting process, the waste volume may be reduced to 50–85%. The composting methods may use manual or mechanical means and are accordingly known as a manual or mechanical process.

Table 2

State	Per Capita Production g/cap/day	Per capita disposal g/cap/day	Collection Efficiency
India Sample Average	377	273	72
Andhra Pradesh	346	247	74
Bihar	411	242	59
Gujarat	297	182	61
Haryana	326	268	82
Karnatka	292	234	80
Kerla	246	201	82
M.P.	229	167	73
Maharashta	450	322	72
Orissa	301	184	61
Punjab	502	354	71
Rajasthan	516	322	62
Tamil Nadu	294	216	73
U.P.	439	341	78
West Bengal	158	117	74

B2. VERMICOMPOSTING

Vermicomposting means stabilization of organic waste with the joint action of earthworms and aerobic microorganisms. At start, microbial decomposition of biodegradable organic matter takes place through extra cellular enzymatic activity known as primary decomposition. Earthworm starts to feed on partially decomposed matter and they start eating five times their body weight of organic matter every day. The intake food is further decomposed in the gut of the worms. It results the size of particle. The worm cast is a fine, odorless and granular product. Worm cast can serve as a bio fertilizer in agriculture. Vermicomposting is being used in Hyderabad, Bangalore, Mumbai and Faridabad and at many more places. However, the area required for Vermicomposting is larger, when approached to dry composting. (Fig. 3)

B3.ANAEROBICDIGESTION (BIOMETHANATION)

In this process organic waste is buried in pits under partially anaerobic conditions, here it will be acted upon by anaerobic microorganisms and produces methane and carbon dioxide gas. After this the organic residue leftover is very good manure. The processing speed of this process is slower than aerobic composting. This process occurs naturally in landfills. Anaerobic digestion leads to biogas production. As we know that biogas contain 55–60% methane, so it can be used directly as a fuel or power generation as well. It is estimated that with controlled biomethanation, 1 ton of waste produces 2–4 time as much methane in 3 weeks in comparison to what 1 ton of waste in landfill will produce in 6–7 years. The government is taking steps for biomethanation technology as a secondary source of energy by utilizing industrial, agricultural and municipal wastes.

C. THERMAL TREATMENT TECHNIQUES OF MSW

Destruction of waste with the help of heat energy is termed as thermal treatment of waste. Although there are many approaches for thermal processes but incineration is the most widely used method.

C1. INCINERATION

Control and complete combustion, for burning solid wastes is known as Incineration. It leads to the recovery of energy and destruction of poisonous wastes, e.g. waste from hospitals, industries etc. The range of temperature in the incinerators varies between 980 and 2000^{o}C. One of the most distinctive features of the incineration process is that it is used to reduce the original volume of combustible solid waste by 80–90%.

C2. GASIFICATION TECHNOLOGY

In this process Incineration process is performed, so incineration of solid waste under less oxygen conditions is called gasification. The main objective of gasification is to produce fuel gas, which would be stored and used when required. In India, there are few gasifiers in working condition, but they are mostly used for burning of biomass such as agro-residues, sawmill dust, and forest wastes. It can also be used for solid waste treatment after drying. Two different designs of gasifiers exist in India. The first one (NERIFIER gasification unit) is installed at Nohar, Hanungarh, Rajasthan by Narvreet Energy Research and Information (NERI) for the burning of agro-wastes,

sawmill dust, and forest wastes. The waste-feeding rate is about 50–150 kg/h and its efficiency about 70–80%. About 25% of the fuel gas produced may be recycled back into the system to support the gasification process, and the remaining is recovered and used for power generation. The second unit is the TERI gasification unit installed at Gaul Pahari campus, New Delhi by Tata Energy Research Institute.

C3. RDF (REFUSE DERIVED FUEL) PLANTS

The main objective of the refuse derived fuel (RDF) method is to generate an improved and efficient solid fuel or pellets from waste. In India, many RDF plants are in working at Hyderabad, Guntur and Vijayawada in Andhra Pradesh State. The Hyderabad RDF plant was started in 1999 near the Golconda dumping ground with a 1000 t/day capacity. But this plant is receiving only 700 ton/day at present. The RDF production capacity of this plant is about 210 ton/day as fluff and pellets. This fuel is being used for production of power about 6.6 MW.

V. CONCLUSION

As India is a developing country and have many techniques and facilities but due to lack of awareness we are not able to solve this problem. Lack of attention towards the duties assigned to the govt. officers like a hurdle due to which India is not able to cope up in waste management if compared with other countries. Some effective measure should be taken for the growth and development of the society such as proper recycling of waste, making goods from solid waste by proper treatment, which results in rising employment for unemployed peoples. Strict laws should be passed in this regard for proper disposal of waste their treatment. New plan of any residential, commercial area should not be passed until and unless it has no proper place for disposal of waste and its treatment. Public participation is of paramount importance and can provide big results if seek properly.

VI. OBJECTIVE OF THE STUDY

The main objective of the study is to aware the generation about the proper dumping of wastage and to aware the researcher for further development.

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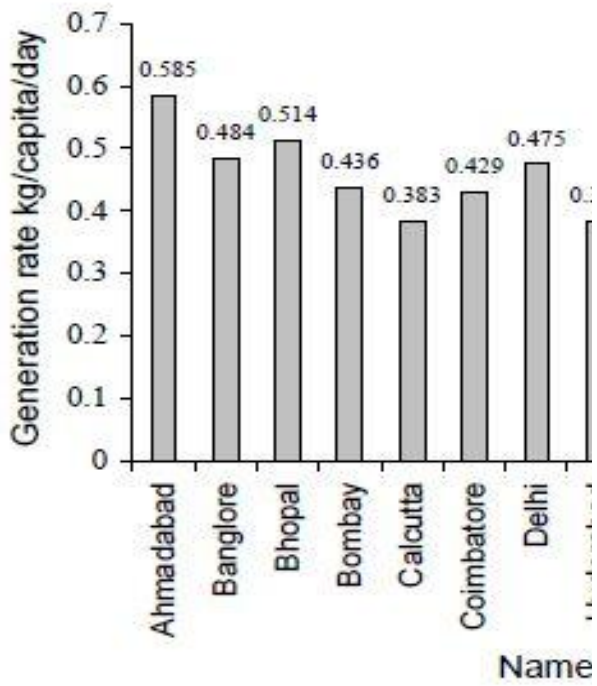

Fig.1. Per capita generation rate of MSW for Indian cities

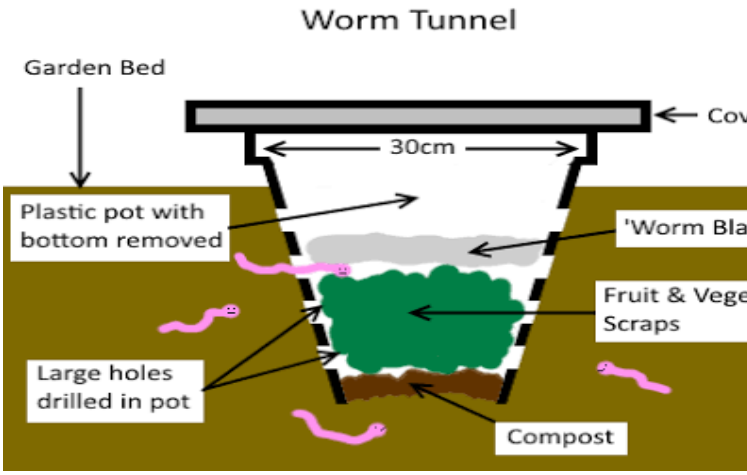

Fig. 3 Vermicomposting

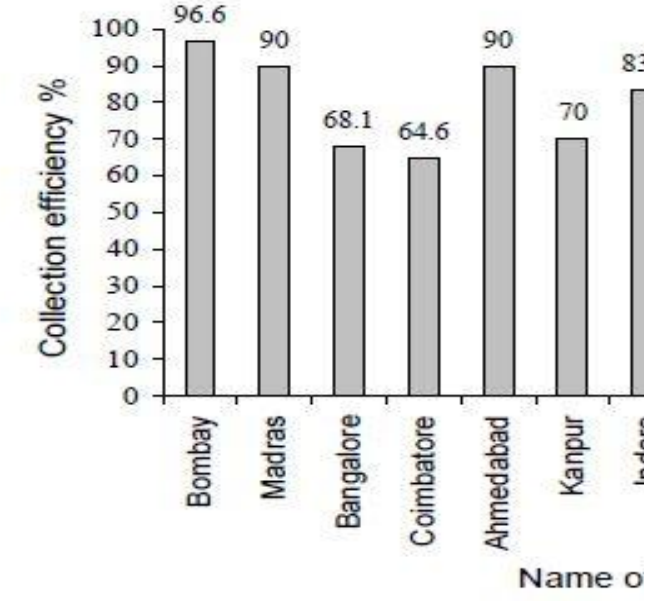

Fig. 2 Collection efficiency of MSW for Indian cities