STUDY ON THE MUNICIPAL SOLID WASTE GENERATED IN THE DELHI CITY

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ABSTRACT: Solid wastes constitute a mounting problem and have increased expanded mindfulness over late years. The measure of strong waste created on the planet is relentlessly expanding and no one cares about this problem. This paper present the study the solid waste generated in the delhi city and what are the major causes to generated by the help of government organizations. To trace the problem related to municipal solid waste management with some suggestion for better management. Delhi is the capital and having so much population in this area. All the data collected by the help of organizations such as CPCB, NEERI and different MCD Zones. this examination is prescribed that reasonable objectives and time spans should be built up, obligations and duties of national and nearby governments and industry illuminated and financing needs to be dispensed keeping in mind the end goal to create a viable waste administration structure in creating.

Keywords: Solid waste management, CPCB, Delhi

1. INTRODUCTION:

Municipal solid waste (MSW) incorporates squander from families, non-dangerous strong waste from mechanical, business and institutional foundations (barring bio-therapeutic waste in introduce setting), market waste, yard waste, agricultural wastes and street sweepings. Throughout the following two decades, developing urbanization in India will bring about a gigantic increment of waste. By the year 2021, the urban populace is required to speak to 41% of the general populace. An investigation led by the CPCB on administration of MSW in the nation assesses that waste age from the present 48 million tones (MT) every year is relied upon to increment to 300 MT for every year, by the year 2047 (490 g for every capita to 945 g for every capita). The assessed necessity of land for transfer would be 169.6 square kilometer (km2) in 2047 as against 20.2 km2 in 1997 (CPCB 2000a).India produces 48.0 MT of MSW yearly at exhibit. ˙ Urban populace expanding between 3 – 3.5 % per annum. ˙ Per capita squander age in India is expanding by 1.3 % per annum. ˙ Yearly increment of waste age in India is around 5%. To handle the waste produced in urban regions, the urban neighborhood bodies are contributing around 35 - 50 % of its accessible assets, spending about Rs. 500-1500 for every ton on strong waste administration. Thus there is a critical need to expand effectiveness for better administration conveyance and streamlining. In perspective of developing test of strong waste administration in the nation, the Central Government has consolidated strong waste administration as one of the parts in the Jawaharlal Nehru National Urban Renewal Mission (JNNURM) program, started by the Central Government for expanding money related assets. Numerous urban communities are getting advantage from this enormous program.

As per the CENTRAL POLLUTION CONTROL BOARD manual on solid waste management (year 2000) the estimated waste generation in the country is 30058 TPD. CPCB in assistance with NEERI has survey records of waste generation and characteristics for 59 cities (35 Metro Cities and 24 State Capitals of the country. The list of these waste generation rates and waste characterizations are given in Table 1:

Table 1: Waste Generation Rates of different cities/states in India (source: CPCB; EPTRI 1999-2000, NEERI-Nagpur 2004-2005, CIPET 2010-11)

Sr.No.	Name of City	*Municipal Solid Waste (Tonnes per day)		
		1999-2000(a)	2004-2005(b)	2010-11(c)
1.	Agartala	-	77	102
2.	Agra	-	654	520
3.	Ahmedabad	1683	1302	2300
4.	Aizwal	-	57	107
5.	Allahabad	-	509	350
6.	Amritsar	-	438	550
7.	Asansol	-	207	210
8.	Bangalore	2000	1669	3700
9.	Bhopal	546	574	350
10.	Bhubaneshwar	-	234	400
11.	Chandigarh	-	326	264
12.	Chennai	3124	3036	4500
13.	Coimbatore	350	530	700

14.	Daman	-	15	25
15.	Dehradun	-	131	220
16.	Delhi	4000	5922	6800
17.	Dhanbad	-	77	150
18.	Faridabad	-	448	700
19.	Gandhinagar	-	44	97
20.	Gangtok	-	13	26
21.	Guwahati	-	166	204
22.	Hyderabad	1556	2187	4200
23.	Imphal	-	43	120
24.	Indore	350	557	720
25.	Itanagar	-	12	102
26.	Jabalpur	-	216	400
27.	Jaipur	580	904	310
28.	Jammu	-	215	300
29.	Jamshedpur	-	338	28
30.	Kanpur	1200	1100	1600
31.	Kavaratti	-	3	2
32.	Kochi	347	400	150
33.	Kohima	-	13	45
34.	Kolkata	3692	2653	3670
35.	Lucknow	1010	475	1200
36.	Ludhiana	400	735	850
37.	Madurai	370	275	450
38.	Meerut	-	490	52
39.	Mumbai	5355	5320	6500
40.	Nagpur	443	504	650
41.	Nashik	-	200	350
42	Panjim	-	32	25
43	Patna	330	511	220
44	Pondicherry	-	130	250
45	Port Blair	-	76	45
46.	Pune	700	1175	1300
47.	Rajpur	-	184	224
48.	Rajkot	-	207	230
49.	Ranchi	-	208	140
50.	Shillong	-	45	97
51.	Shimla	-	39	50
52.	Silvassa	-	16	35
53.	Srinagar	-	428	550
54.	Surat	900	1000	1200
55.	Thiruvananthapuram	-	171	250
56.	Vadodara	400	357	600
57.	Varanasi	412	425	450
58.	Vijayawada	-	374	600
59.	Vishakhapatnam	300	584	334
	Total MSW	30058	39031	50592

2. CASE STUDY OF DELHI

2.1 Study Area

The region chose for the present examination has an extraordinary position with respect to its area (Map 1). National Capital Territory of Delhi (NCT), from the populace size of view it is the second biggest city in India and it is the 6th biggest city on the planet. Being a national capital of nation, it has various government workplaces, foundations, associations and so forth. Delhi is located in North India between the latitude of $28^{o}24'17"$ to 28^{o} 53' 00" North and longitude of $76^{o}50$ '24" to $77^{o}20'$ 37" East. The area of the National Capital Territory of Delhi is 1484.46 sq.

km. (0.4 percent of total geographical area of India). The spatial examination of the quantity of containers, vehicles and safai-karamcharies uncovers that their accessibility progressively decays from center to outskirts zones of MCD. By and by, all current three landfills (Bhalswa, Gazipur and Okhla) are completely pressed and flooding. Among four landfill destinations, Bhalswa is getting greatest waste from six zones of MCD though Gazipur, Okhla and Narela-Bawana tailed it. All the while, it is important to diminish the weight on landfill destinations sooner.

Figure 1: Map of Delhi (Google source image)

2.2 Waste Generation

Delhi is one of the biggest cities in the world and it is known as most polluted city too. The Environmental Protection Training and Research Institute (EPTRI) estimates place MSW generation in Delhi at 4,000 tons per day whereas National Environmental Engineering Research Institute (NEERI) study estimates the present solid waste generation in MCD area of Delhi 6000-7000 tons per day. A study carried out by MCD for estimating the quantity and characteristics of MSW during the year 2005 and it has indicated that Delhi generates about 8567 tons of waste every day. The waste generation in MCD area, NDMC, and Delhi Cantonment Board area is about 6300 tons, 900 tons, and 100 tons daily respectively (IL& FS Eco smart Report, 2005). According to CPCB, 2010-11, Delhi is generating highest quantity of municipal solid waste with 6800 tons per day followed by Greater Mumbai and Chennai.

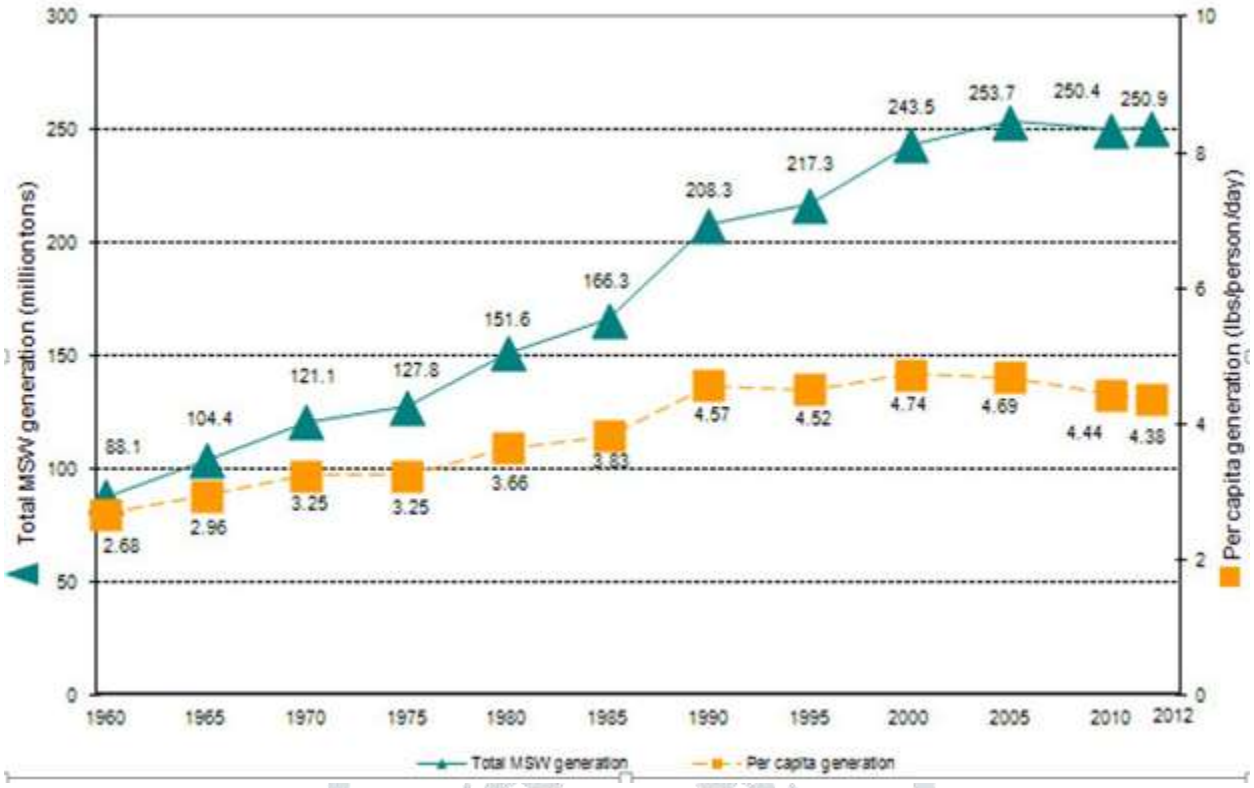

Figure 2: Growth of Municipal Solid Waste Generation (Source: MCD, Delhi, 1960-2012)

The socio-economic status is directly interrelated with the waste generation quantity in the family. Education wise, out of total moderately educated respondents (up to senior secondary), 75 percent of their families were generating the garbage up to 2 kgs waste daily. There were 87 households, who were producing the waste above 2 kgs per day and 43 households of them belonged to above graduation and professional courses.

Table 2: Waste Generated in Delhi (source: CPCB; Aswani et al., 2013: primary survey)

Quantity (Per day) (In kg)	Illiterate	Primary	Middle	Matric	Senior Sec	Graduate	Post-Graduate	Others	Total
Up to 1	7	1	0	9	7	24	13	3	64
1.1-2	22	14	4	13	15	51	24	6	149
2.1-3	13	6	4	2	3	9	19	5	61
3.1-4	3	2	1	5	2	7	3	0	23
4.1-5	0	0	0	1	0	0	0	0	1
Above 5.1	1	0	0	0	1	0	0	0	2
Total	46	23	9	30	28	91	59	14	300

2.3 Physical and Chemical Characteristics Of Waste

A few investigations have been led by various associations in Delhi and organizations (IHPH 1982, NEERI 1996, TERI 2002) to decide the physical and compound sythesis of MSW. The Table 2 mirrors that biodegradable waste is created most extreme in all the three years (1982, 1995, and 2002) however in 1995 and 2002 the organization was relatively unaltered. The inert matter is produced in huge quantity (i.e. 34.7 per cent in 2002 & 1995) it is because of high pace of construction and demolition activities in Delhi The Table 3 discusses the chemical composition of municipal solid waste in Delhi. In this specific circumstance, different examinations have been led by various offices which have just been talked about the strong waste based computation of compound creation of MSWIt has been watched that the waste is described by high moisture content i.e. 43.8 per cent. The organic carbon, Nitrogen, Phosphorus, Potassium, C/N Ratio and Calorific value of MSW is recorded at 20.5 per cent, 0.9 per cent, 0.3 per cent, 0.7 per cent, 24.1 per cent and 713 k Cal/kg, respectively. If we compare the two studies which were conducted by TERI 2002 and IHPH 1995, we found that the circumstance is relativelyalmost unchanged. In Delhi, it has been observed that the rapid growth of rag pickers has given rise to change in composition of collection of waste.

Table 3: Physical Characterization of Waste (source: TERI (2002), NEERI (1996), IHPH (1982)

Parameters	2002	1995	1982
Biodegradable	38.6	38	57.7
Paper	5.6	5.6	5.9
Plastic	6	6	1.5
Metal	0.2	0.3	0.6
Glass and Crockery	1	1	0.3
Non-biodegradable (leather, rubber, bones and synthetic material)	13.9	14	5.1
Inert (stones, bricks, ashes, etc.)	34.7	34.7	28.9

Table 4: Chemical Characterization of WasteMSW (source: TERI (2002), NEERI (1996), IHPH (1982)

Parameters	2002	1995	1982
Moisture	43.8	43.7	15-40
Organic carbon	20.5	20.5	22.8
Nitrogen as N	0.9	0.9	0.86
Phosphorus as P_2O_5	0.3	0.3	0.74
Potassium as K_2O	0.7	0.7	0.52
C/ N ratio	24.1	24	28
Calorific value (kCal/kg)	713. 0	712. 5	661- 1200

3. STORAGE AND COLLECTION OF MUNICIPAL SOLID WASTE

Storage of waste at source is the main fundamental advance of Solid Waste Management. Each family, shop and foundation produces strong waste each day. The gathered waste is put away in dhalaos generally solid structures differing in measure from 4.5 x 3 meters to 13.5 x 9 meters. These can store 4 to 16 tons of garbage (Pal, 2005). The requirement of dhalaos and dustbins is fundamentally relies on the solid waste generation per capita per day. Presently, MCD supplanted old framework and by putting trolleys and littler containers. Quantity of the waste as per the zonal division is tabulated in Table 3.

Table 5: Quantity of Collection places of Waste (source: MCD 2012)

Name of Zone	Dhalaos	Dustbins	Open Sites
South zone	227	136	72
Central zone	188	45	75
City zone	46	32	13
S. P. Zone	49	-	-
Karol Bagh zone	57	21	6
West zone	201	1	14
Najafgarh zone	56	1	135
Rohini zone	267	30	6
Narela zone	34	7	62
Civil Line zone	107	41	21
Shahdara (S) zone	157	18	18
Shahdara (N) zone	105	10	11
Total	1494	342	433

4. DISPOSAL OF MUNICIPAL SOLID WASTE-

Presently in study area, there are four landfilling site in operations which covers 202 acres of land situated in various zones in various bearings. Bhalswa, Gazipur, Okhla and Narela/Bawana landfill sites are in process. The Municipal Corporation of Delhi is in charge of the administration of every one of the four existing landfill destinations. Alternate organizations like Delhi Metro Rail Corporation (DMRC) and Agricultural Produce Market Committee (APMC) and so forth arrange off their loss on the MCD controlled landfill destinations

These agencies paid for the disposal of their waste on MCD landfill sites tipping expense charges which change from Rs. 205 to Rs. 235 for every Gazipur and Okhla have relatively depleted their ability however squander dumping is proceeding with which drives flooding and posturing negative effects on human's wellbeing and condition. In this way, a dire need to new landfill site in not so distant future.

Table 6: Landfill Sites Serving MCD Zones (Source: MCD, 2012)

Landfill Site	Area (In Acres)	Population (In %)	D.O.C	Zones Supplying Waste
Bhalswa	40	50.3	Almost saturated	Civil Lines, Karol Bagh, Rohini, Narela, Najafgarh and West
Gazipur	70	30.8	Almost saturated	Shahdara (S), Shahdara (N),City, SadarPaharganj, and NDMC
Okhla	32	18.9	Almost saturated	Central, Najafgarh, South and DCB
Narela/Bawana	60	-	-	Rohini, Civil Line and Najafgarh

5. PROBLEMS RELATED TO MSWM IN DELHI:-

As per the above study has been done, there are many reasons and problems created to decompose the solid waste:
Bins and dhalaos are not cleared regularly;
Lack of proper maintenance of dhalaos, dustbins and waste storage points
Lack of financial resources;
Number of regular operators is much lesser than required. Most of the requirement is fulfil by temporary staff personnel;
The three operational landfill sites namely Bhalswa, Gazipur and Okhla have almost exhausted their capacity but waste dumping is continuing which leads.
Vehicles are poorly maintained. It is because of an inadequate workshop facilities and maintenance procedures. This problem has leads to frequent breakdown and trucks used, are out of service for long periods.

6. Conclusion

Management of municipal solid waste in the city is far from satisfactory. There are problems in the solid waste management practices prevailing in the city at every level, i.e., collection, transportation, processing and disposal. Mismanagement of solid waste is a matter of serious concern for public health and environment. Some suggestions would be helpful in improving SWM system in Delhi these are as follow:

- Open waste storage sites and other unhygienic street bins should not be allowed.
- The placement of waste receptacles should be correct.
- Segregation of household waste at the source would reduce the burden of solid waste significantly while at the same time improve the supply of composite serving the nutrient poor farmer near Delhi.
- Proper maintenance of vehicles and other equipments.
- Government should adopt 4R's (Reduce, Reuse, Recycle and Resource Recovery) principle.
- Government should increase the number of composting and energy generation plant.

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